

Dirty Fashion *revisited:* Fashion

Spotlight on a polluting viscose giant



Contents

Executive Summary	5
Part 1 - Introduction	9
Part 2 -Viscose: sustainable fibre of the future?	11
2.1 Why is it important for industry to move towards responsible viscose manufacturing?	12
Part 3 - Aditya Birla Group	13
3.1 Grasim Industries Ltd., India	13
3.1.1. Expansion of Grasim Industries: a US\$400 million project	14
3.2. PT. Indo Bharat Rayon, Indonesia	15
3.3 Aditya Birla Group's approach to sustainability	15
Part 4 - View from the ground: India and Indonesia	17
4.1. Grasim Industries, Birlagram, India	17
4.1.1. Summary of findings	18
4.1.2. Contaminated water	18
4.1.3. Health conditions	19
4.1.4. Fluorosis	22
4.1.5. Impacts on agriculture	22
4.1.6. Air pollution	23
4.1.7. Worker safety: 'one death per month'	25
4.2. PT. Indo Bharat Rayon, Indonesia	25
4.2.1. Summary of findings	25
4.2.2. Water pollution	26
4.2.3. Government and company action	26
Infographic: Which brands buy from Aditya Birla	28
4.2.4. Waste	29
4.2.5. Protests against IBR	29
Part 5 - Conclusion & Recommendations	31



This report was researched and written by the Changing Markets Foundation in collaboration with independent researchers. The purpose of this report is to shed light on industry-specific issues related to environmental and health impacts in the production of viscose fibre at selected locations in India and Indonesia. The information in this document has been obtained from sources believed reliable and in good faith. The authors accept no liability whatsoever for any direct or consequential loss arising from the use of this document or its contents.

Published in February 2018.
www.changingmarkets.org

Designed by Pietro Bruni - helloo.org



Narrow opening in the river that leads to a discharge pipe from Aditya Birla's viscose factory in Purwakarta, Indonesia

The Aditya Birla Group is a global corporation with a market value of US\$50 billion. Headquartered in Mumbai, India, it is one of India's largest conglomerates and owns over 40 subsidiaries operating in a wide range of industrial sectors, including aluminium, cement, power generation, telecommunications, financial services and textiles.

The group is the world's leading producer of viscose, with factories located across Asia. Birla also owns factories in Europe, notably Sweden's Domsjö, a speciality pulp and bio-refinery company that it acquired in April 2011. The group's Pulp and Fibre business is spread over eight countries and covers the entire viscose value chain, including plantations and the production of dissolving grade wood pulp, chemicals such as carbon disulphide and caustic soda, power generation, viscose fibre production and final consumer products.¹ It owns 12 mills in total: 7 viscose mills and 5 dissolving pulp mills.² Its Indian manufacturing arm, Grasim Industries Ltd., which commenced operations in 1947, is described as the '*flagship company of the Aditya Birla Group*'.³ In January 2018, Grasim received government clearance for the expansion of its viscose staple fibre (VSF) plant in Gujarat. The project will require an investment of around US\$400 million, and the company plans to double its VSF production capacity.

In addition to being a market leader, the Aditya Birla Group aims to become '*the leading Indian conglomerate for sustainable business practices across its global operations*'.⁴ In November 2017, it was ranked number one globally by the NGO Canopy for its work on the conservation of ancient and endangered forests

in the sourcing of wood pulp, placing it ahead of ten other producers representing roughly three-quarters of global viscose production.⁵ However, in June 2017, our *Dirty Fashion* report shone a light on the environmental damage caused by irresponsible production practices at Aditya Birla Group viscose plants in India and Indonesia, and described how pollution there was blighting people's lives and destroying livelihoods. The report also highlighted links between the polluting factories and global markets by identifying some of Birla's customers, including major fashion brands and retailers such as H&M, Zara (Inditex), ASOS, M&S and Tesco.

This report presents findings from two follow-up investigations conducted at Aditya Birla Group's plants in Nagda (Madhya Pradesh, India) and Purwakarta (West Java, Indonesia) in November and December 2017. It shows that, while the company is keen to broadcast its sustainability credentials, when it comes to viscose production it is failing to implement even basic legal requirements. In addition to multiple first-hand witness accounts of the company's wrongdoing, independent laboratory testing found that air and water emissions of some contaminants exceed regulatory limits, indicating a serious potential threat to the local environment and the health and wellbeing of its workers and the communities living in the shadow of its factories. The report finds the following in particular.

At Aditya Birla Group's site in Madhya Pradesh, India:

- Conditions on the ground were markedly worse than dur-

ing our previous investigation in spring 2017; more sites were characterised by visible and highly odorous pollution, which had turned the water dark red.

- There was a major health incident in October 2017, resulting in the death of two residents of Parmarkhedhi, a village 8km downstream of Grasim Industries on the opposite bank of the Chambal River. Sixty villagers fell seriously ill and lost the ability to walk. Locals claim the incident was caused by contaminated water originating from the Birlagram industrial estate, where the Grasim viscose plant is located (although Birla has denied these claims).
- An independent laboratory tested an air sample taken outside the Grasim plant and found that the level of carbon disulphide was 125 times the World Health Organization (WHO) guideline value.⁶ Carbon disulphide is a dangerous chemical; it impacts the nervous system and is suspected of damaging fertility and the unborn child, even at low concentrations.⁷
- Contamination has left the villages surrounding Grasim Industries without access to drinking water. In several villages, well water has made people and animals sick, forcing local residents to look for safe and clean water sources outside their villages.
- People in communities surrounding the factory are suffering from serious health conditions, including cancer, tuber-

culosis, reproductive problems, birth defects and stomach disorders.

- Contaminated water has wiped out most forms of agriculture in the area surrounding the Birlagram industrial estate. Farmers are unable to obtain a fair price for their produce at local markets because of fears it is contaminated.
- Various sources report alarmingly poor worker safety within the Grasim plant, with repeated accidents and deaths in the workplace.

At the Group's Indo Bharat Rayon (IBR) plant in Purwakarta, West Java:

- Locals report regularly witnessing evidence of illegal discharges by IBR, usually at night-time or after rainfall.
- Our investigators observed discharge coming from IBR, which was steaming hot and accompanied by thick foam.
- An independent laboratory's testing of water samples showed that the river water around IBR's discharge pipe is extremely polluted and does not even comply with 'worst-in-class' Indonesian water quality standards, meaning it should not even be used for irrigation, let alone drinking or bathing.
- Children were seen bathing in the contaminated water close to the discharge pipe, and farmers were found to be

using the river water for irrigation and fish farming.

- The villagers' complaints seem to be falling on deaf ears, and Aditya Birla Group lacks a credible grievance procedure to properly acknowledge and address local concerns and complaints.

Our engagement with companies since the publication of the *Dirty Fashion* report has shown that there is significant appetite among clothing brands and retailers to ditch dirty viscose and roll out clean production throughout fashion supply chains. However, the position of manufacturers is more mixed. One viscose producer, Austria's Lenzing, was quick to take responsibility for the serious problems we highlighted at its plant in Purwakarta, Indonesia. The company has since drawn up a roadmap in which it has committed to complete investment in closed-loop production at the site by 2022. Chinese producers, including Sateri and Tangshan Sanyou, which featured in *Dirty Fashion*, have also come together in an initiative to promote sustainable sourcing and establish a unified approach for driving and measuring sustainability in the viscose industry, although the level of their ambition remains to be seen.⁸

In contrast, Aditya Birla Group has persisted in comprehensively rejecting our findings and denying, in the face of all the evidence to the contrary, that there are any significant problems at their factories. This is all the more shocking given that the company is using sustainability as a calling card with the major brands and retailers that make up its customer base. Against the backdrop of a clothing industry that is becoming increasingly

sensitive to suppliers' environmental performance, Aditya Birla Group seems mainly to be paying lip service to clean viscose production, without investing in the production technologies and wastewater treatment systems that would make it a genuine green leader. Meanwhile, it plans to channel millions of dollars into the expansion of its viscose production capacity, eyeing global growth of its man-made cellulose business.

To live up to its commitment to customers and sustainable investors, Birla needs to acknowledge and urgently address the problems highlighted in our investigations, and start working to become part of the solution by engaging with brands, communities and workers. It should move its operations towards closed-loop manufacturing, which significantly reduces environmental emissions and enables the recovery of hazardous chemicals. With viscose representing a growing share of global fibre demand, Aditya Birla needs to act now to clean up its factories and ensure closed-loop production is standard for any new viscose production capacity that is introduced.

Our *Roadmap towards responsible viscose and modal fibre manufacturing*, which is published alongside this report, lists relevant standards that address pollution in viscose fibre production. It concludes that the EU Best Available Technique (BAT) standard (2007) is ambitious, achievable and covers most of the key pollution parameters. Birla should therefore commit to investing in improving its operations in line with this standard, and according to a concrete timeline that identifies key milestones, to make good on its claim of being a sustainable producer.



Women receiving cough syrup and free medicine in the village of Atalwada, reportedly following an increase in complaints about industrial pollution-related diseases and disorders



Water seen flowing from IBR plant's discharge pipe in Indonesia directly into the river

1. Introduction



According to people living in the vicinity of the Grasim plant, contaminated water is the main threat to health, agriculture and livelihoods in the area

Viscose has the potential to become the sustainable fibre of the future. After polyester and cotton, it is the most-used fibre in the textile industry.⁹ It is often marketed on the basis of its 'eco-friendliness'; many brands and retailers opt for viscose as a more ecological alternative to pesticide-intensive cotton or synthetic fibres based on petrochemicals (e.g. oil). Viscose is produced from cellulose, which is a component of tree and plant biomass, and is biodegradable at the end of life.

However, throughout history and to this day, viscose production has come under fire over health issues related to chemicals used in the manufacturing process. Carbon disulphide, currently essential to viscose fibre production, is a highly hazardous chemical and affects health at very low concentrations. With the shift of viscose manufacturing from Europe and the United States to Asia at the end of the 20th century, these dangers sank out of view. For many years, the risks facing workers and local communities in China, India and Indonesia, where most of the new factories were established, went largely unreported.¹⁰

In June 2017, our *Dirty Fashion* report¹¹ shone a light on the damage to the environment and human health caused by irresponsible viscose production. Case studies of nine manufacturing plants in China, India and Indonesia demonstrated the systemic nature of the problem, which was not confined to a couple of rogue operators but affected the industry as a whole. The report also explored links between the polluting factories and global markets by naming some of their customers, including major fashion brands and retailers such as H&M, Zara (Inditex), ASOS, M&S and Tesco.

This report is an update on the situation on the ground at viscose manufacturing plants in India and Indonesia with a spotlight on Aditya Birla Group, the world's biggest producer of viscose fibre, which has consistently denied the findings of

the *Dirty Fashion* report.¹² The family-owned US\$50 billion conglomerate based in Mumbai, India, features in India's Fortune 500 list and dates back to the early 20th century, when the Birla family had close ties to Mahatma Gandhi in the move towards Indian independence.¹³ Today, Aditya Birla Group accounts for about 20% of the world's viscose supply, selling viscose to high street brands.

Aditya Birla claims it is committed to sustainability and complies with recognised international standards. In 2017, the group was ranked number one by Canadian NGO Canopy for commendable practices in sourcing wood pulp for use in viscose production. The company also started collaborating with the Swedish government in the area of 'smart textiles', which could result in Sweden scaling up investments in Birla's textile manufacturing business

However, *Dirty Fashion* painted a very different picture. It revealed that two of Aditya Birla's viscose plants - Grasim Industries Ltd. in India and PT Indo Bharat Rayon (IBR) in Indonesia - have released untreated wastewater and polluted air into the local environment, causing dire environmental and living conditions for villagers surrounding the two factories. Since publication of the report, Changing Markets has engaged with the Aditya Birla Group, which has consistently denied all the allegations in the report and failed to put forward a plan to remediate the situation on the ground (see Box 1).

This report summarises findings from on-the-ground investigations at two Aditya Birla Group factories in India and Indonesia, and surrounding residential areas, since the publication of *Dirty Fashion*. It reveals how the world's leading viscose producer is failing to respond to community calls for it to clean up pollution and improve its production processes

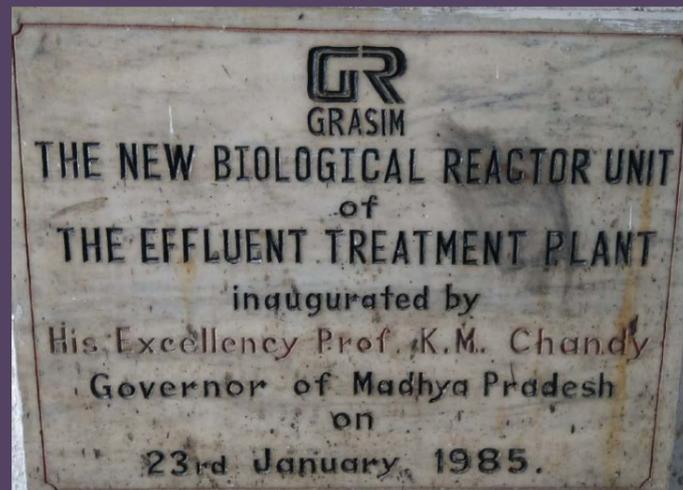
BOX 1: Aditya Birla Group's reaction to the *Dirty Fashion* report

Following publication of *Dirty Fashion*, Changing Markets had several meetings with clothing brands, retailers and viscose producers, including two meetings with representatives of Aditya Birla Group in September 2017 and February 2018. During the first meeting and subsequent communications through letters and emails, the company denied all of the report's findings and failed to commit to any activities that would improve the situation. As a result, Changing Markets investigated whether the situation on the ground had changed in the meantime (the findings are included in this report), and asked Birla for additional documentation to support its claims.

In the documents it submitted to Changing Markets, Birla continues to claim that wastewater and air emissions at its Grasim plant meet all applicable norms, and that the company does not contribute to the pollution of the Chambal River, where its plant in Madhya Pradesh is located. As proof, it provided: a photo of the effluent treatment plant's inauguration plaque; a photo of a worker looking at the screen of its continuous effluent monitoring system; two sets of water emissions monitoring results, taken in August and September 2017 from a single sampling spot, described as 'effluent treatment plant outlet'; one set of air emissions monitoring results, taken in January 2017 from samples at the company's spinning mill and power plant. Birla provided no further explanation of how frequently sampling takes place or whether more locations are sampled at, and failed to explain why it does not appear to communicate industry-specific parameters. It also failed to mention a recent Central Pollution Control Board report highlighting that the company's emissions had exceeded prescribed pollution limits in August 2017 (discussed in further detail later on in this report), or long-standing complaints from residents living in the vicinity of its factories and how it intends to address them. What is more, it seems the company lacks a grievance procedure to transparently resolve local complaints.

For its Indonesian plant, Indo Bharat Rayon (IBR), Changing Markets asked Birla to provide evidence of environmental inspections and information about their frequency and outcomes. Birla sent evidence of three inspections, which took place in 2017, but each related to a different part of the factory (landfill, power plant and just one examining wastewater management). Besides being very irregular, these inspections do not seem to monitor industry-specific parameters. For example, villagers frequently complain about air pollution, which none of the inspections shared with Changing Markets analysed. Birla claims to conduct its own 'village surveys'; it told us the dates of these, but did not provide any further details or records of how any complaints that might have arisen were resolved.

Instead of providing concrete evidence of how it is currently taking steps to reduce pollution and deal with complaints, Birla sent us certificates of awards it received in 1999–2000 and 2004 for good environmental management. It also supplied proof that it holds an Oeko-Tex certificate, which relates to the presence of chemicals in final products but does not cover manufacturing. This further demonstrates Birla's failure to meaningfully engage to resolve the situation on the ground; instead, it appears to be channelling its energies into greenwashing its image.



Examples of documentation that Aditya Birla provided in exchanges with Changing Markets Foundation.

2. Viscose: sustainable fibre of the future?

Viscose is becoming increasingly popular; many consider it to be a sustainable fibre of the future. This is because it is biodegradable and can be produced in a more sustainable way than oil-based synthetic fibres or pesticide- and water-intensive cotton.

It is produced from cellulose, which can be obtained from a variety of trees, bamboo or cotton linters (fine, short fibres that stick to the cotton seed after ginning).¹⁴ The fibre is prized for its cotton- and silk-like qualities, and has a wide range of uses, from the fashion industry to home furnishings and packaging. Developed at the end of the 19th century, it was the first ever 'man-made cellulose fibre'.¹⁵

There are various types of man-made cellulose fibres on the market today, including viscose, modal and lyocell, all of which use different approaches to 'regenerate' cellulose. However, viscose remains the dominant production method, representing more than 70% of the global viscose market; modal and lyocell represent 19% and 9% respectively.¹

The term **viscose fibre** refers to viscose filament yarn and viscose staple fibre (VSF). Viscose filament yarn is a spun thread ready for weaving into textiles, while staple fibres are cut into short pieces during production and can be blended with other fibres into textile yarns or processed into 'non-woven' products later on, such as wound dressings, wipes and sanitary towels.

Viscose is often marketed as a 'natural' or 'eco-friendly' fibre. However, a number of hazardous chemicals are involved in viscose production, which require proper management to min-

imise their negative impacts. These chemicals - carbon disulphide, sodium hydroxide and sulphuric acid - are used to treat the cellulose wood pulp. While they do not necessarily remain as residues in the final product, their release at different stages of the production process can have a significant impact on the environment, aquatic ecosystems and the everyday life and health of communities in the vicinity of viscose factories.

Carbon disulphide is a powerful solvent, recognised for its potent and special toxicity. Workers exposed to high concentrations of carbon disulphide are known to suffer from neurological and psychiatric symptoms, such as unwarranted anger, mood changes, hallucinations, paranoia, loss of appetite, and gastrointestinal and sexual disorders.¹⁶ Several reports further speak of reproductive effects, birth defects, leukaemia, chronic skin conditions¹⁷ and kidney diseases.¹⁸ For more information on carbon disulphide, see Box 5.

Hydrogen sulphide is generated as a by-product during the viscose spinning process. A highly toxic gas, its presence can be recognised by its distinctive odour of rotten eggs. Hydrogen sulphide can cause irritation of the eyes, function impairment and neurobehavioural changes.¹⁹

Sodium hydroxide, also known as caustic soda or lye, is also required in large amounts for the viscose process. This highly toxic chemical is absorbed through inhalation, ingestion or skin contact; it is known to cause corrosion, skin burns, eye damage and, in the worst-case scenario, death of workers who handle it frequently and without protection.

i The manufacturing of modal is similar to viscose production (although it can be more chemical- and energy-intensive), while the lyocell process uses different chemicals and is created through a different process. Therefore, for the purpose of this report, modal is included under viscose.

Viscose production can have a significant impact on water bodies (such as lakes and rivers) surrounding factories. Pollutants characteristically found in wastewater from viscose production are sulphuric acid, sulphates, sulphur and sulphides. Metals may also be present, namely zinc salts (zinc sulphates and zinc sulfonate cellulose), which can be used as additives in the viscose process. Inadequately treated wastewater can also contain a lot of organic material, which can lead to high levels of chemical oxygen demand (COD). High levels of COD mean less dissolved oxygen is available for aquatic organisms, such as fish, resulting in their death.²⁰

These pollutants present a high hazard for acute aquatic toxicity, meaning a single exposure incident can result in severe biological harm or death to fish or other aquatic organisms.²¹ This severely impacts both wildlife and local communities' ability to access clean drinking water and earn a living from activities such as fishing or aquaculture.

2.1. Why is it important for industry to move towards responsible viscose manufacturing?

Viscose currently has a relatively small market share (6.6%).²² However, with demand for viscose expected to increase by around 5% per year until 2021,²³ it is imperative that the industry takes action now in moving towards responsible viscose and modal manufacturing.



Foaming effluent within 20 metres of a discharge pipe from the Indo Bharat Rayon plant, owned by Aditya Birla, in Indonesia

By 2030, cellulose fibres are set to account for 8.5% of the fibre market; this will require investment in additional manufacturing capacity to meet growing demand.²⁴ Concurrently, governments and consumers are becoming more demanding when it comes to sustainable manufacturing and environmentally friendly products, not least because of growing awareness that current levels of global production and consumption are unsustainable and our planet's resources are finite.²⁵

The viscose market is currently highly concentrated; 11 companies supply approximately 70% of the market.²⁶ The world's two largest viscose producers are India's Aditya Birla and Austria's Lenzing Group, which together represent 35% of global viscose supply.²⁷

In combination, these factors demonstrate the importance of, and opportunity for, rapid action to clean up viscose production. Failure to act presents a substantial reputational and material risk for brands and retailers whose suppliers flout environmental rules.

To tackle this issue, the Changing Markets Foundation has developed a *Roadmap towards responsible viscose and modal fibre manufacturing*, which sets out an ambitious yet realistic and achievable framework for moving the viscose industry towards a more sustainable future.



Aditya Birla Group is a family-owned business, which was closely associated with the Indian state's post-independence industrialisation drive. Today, the US\$50 billion²⁸ corporation, headquartered in Mumbai, is one of India's three largest conglomerates, and manages over 40 subsidiaries²⁹ in 36 countries. These operate across a variety of industries, including aluminium, copper, cement, textiles, carbon black, insulators, natural resources, power, agribusiness, telecommunications, financial services, retail and trading. Manufacturingⁱ is a core part of Birla's business, representing 65% of the group's total revenue.³⁰

The group dominates the viscose fibre industry across South and Southeast Asia, and is the world's leading producer of VSF and filament yarn.³¹ Aditya Birla's umbrella brand for products in this range is Birla Cellulose. It markets the speciality cellulose fibres modal and lyocell under the Birla Modal and Birla Excel

ii Manufacturing includes textiles, cement, chemicals, metals and mining.

3. Aditya Birla Group

brands respectively, and coloured spun-dyed viscose fibre as Birla Spunshades.³² Birla also has its own pure or blended cellulose-based fabric brand, called Liva.

The group began producing VSF in India in 1954. Today, its Pulp and Fibre business is spread over eight countries and covers the entire viscose value chain, including plantations and the production of dissolving grade wood pulp, chemicals such as carbon disulphide and caustic soda, power generation, viscose fibre production and final consumer products.³³ It owns 12 mills in total: 7 viscose mills and 5 dissolving pulp mills.³⁴

The following sections take a closer look at two Aditya Birla Group subsidiaries: Grasim Industries Ltd. in India and PT. IBR in Indonesia.

3.1. Grasim Industries Ltd., India

Grasim Industries Ltd. is the world's leading producer of VSF. It is also India's largest producer of viscose yarn, chemicals and cement.³⁵ Grasim's viscose division, encompassing viscose pulp, fibre and yarn, reported annual revenue of 7,714.64 crore rupees in March 2017, equivalent to US\$1.2 billion.³⁶

Grasim began producing VSF in 1954 at Nagda, Madhya Pradesh, which remains the company's largest manufacturing plant. Other units are located in Kharach and Vilayat in Gujarat, and Harihar in Karnataka.³⁷ All four units produce an aggregated capacity of 498,000 tonnes of VSF per year.

The company also has several joint ventures outside India,

which supply dissolving grade and speciality pulp to VSF units in India, China, Thailand and Indonesia.³⁸ These joint ventures include Domsjö Fabriker AB in Sweden, Birla Lao Pulp and Plantation Company Limited in Laos, Birla Jingwei Fibres Company Limited in China, and AV Group NB (AV Cell and AV Nackawic) and AV Terrace Bay in Canada.³⁹

Recent media reports indicate Grasim has benefited from viscose plant closures in China as a result of the introduction of stricter environmental regulations, which have kept its VSF prices stable against rising Chinese prices.⁴⁰ The business is expected to

expand further, with growing demand for VSF in India, notably through Grasim's own viscose-based fabric brand Liva. Liva sells both to domestic brands and global apparel brands, including Zara and H&M.⁴¹

In July 2017, a merger was completed between Grasim Industries Ltd. and Aditya Birla Nuvo Ltd. At the time of the merger, it was reported that this would increase the Birla family's stake in the new entity to 39% (from the 31% it held in Grasim), with the remaining 61% publicly listed.⁴²

BOX 2: Chinese Collaboration for Sustainable Development of Viscose

In 2017, the Chinese government stepped up enforcement of pollution norms, which resulted in tens of thousands of factories being shut down, fined or accused of criminal offences after a series of inspections by the Chinese Ministry of Environmental Protection. This was part of a national effort to tackle pollution from the country's manufacturing sector and meet air, water and soil quality targets, enforcement of which has largely been discounted in the past. This wave has also hit the textile industry.⁴³

Increased government scrutiny adds to pressure from clothing brands and retailers for cleaner production and increased transparency, which has resulted from initiatives such as Chinese NGO IPE's Green Supply Chain Map.⁴⁴ As a result, the Chinese viscose sector has come together to promote sustainable sourcing and establish a unified approach for driving and measuring sustainability in the viscose industry. The initiative (not yet officially launched, but seen by the Changing Markets Foundation), is called the Collaboration for Sustainable Development of Viscose (CV), and gathers China's ten largest viscose producersⁱⁱⁱ (which collectively account for more than 50% of the world's VSF production) in partnership with China Chemical Fibre Association and China Cotton Textile Association.

The Collaboration's level of ambition is yet to be determined. When officially launched, the initiative will publish a time-bound CV roadmap, built around international sustainability standards and programmes (e.g. Standard 100, Sustainable Textile Production by Oeko-Tex, The Higg Facility Environmental Module, Zero Discharge of Hazardous Chemicals, Programme for the Endorsement of Forest Certification (PEFC) and Forest Stewardship Council (FSC). The Changing Markets Foundation encourages Chinese producers to align with the principles set out in our *Roadmap towards responsible viscose and modal fibre manufacturing*, published alongside this report.

3.1.1. Expansion of Grasim Industries: a US\$400 million project

In January 2018, Grasim Industries received government clearance for the expansion of its VSF plant in Vilayat (Bharuch District, Gujarat), which stretches over 222.63 hectares. The expansion

project will require an investment of around US\$400 million (2,560 crore rupees).⁴⁵

The company plans to double its VSF production capacity from 127,750 to 255,500 tonnes per year. The expansion plan also includes setting up a facility for solvent spun cellulosic fibre with production capacity of 36,500 tonnes per year.

iii Funing Aoyang, Hengtian Helon, Jilin Chemical Fibre, Sateri, Shandong Yamei, Shandong Yinying, Tangshan Sanyou, Xinxiang Bailu Chemical Fibre, Yibin Grace and Zhejiang Fulida.

In addition to this, the company plans to expand its production capacity for sulphuric acid (from 102,300 to 182,500 tonnes per year), carbon disulphide (from 23,725 to 34,675 tonnes per year) and captive power plant capacity (from 25MW to 55MW).⁴⁶

3.2. PT. Indo Bharat Rayon, Indonesia

Aditya Birla's IBR plant is situated in Purwakarta (West Java, Indonesia), along the banks of the Citarum River and adjacent to another viscose factory: Austrian manufacturer Lenzing's South Pacific Viscose. IBR began producing VSF commercially in 1982; today, it is Indonesia's biggest viscose plant and the world's second-largest manufacturer of VSF at a single location. It produces a combination of textile and non-woven products under the brand Birla Cellulose.

In addition to viscose, the company produces chemicals such as anhydrous sodium sulphate and sulphuric acid.⁴⁷ The plant's VSF and sulphuric acid capacity increased in 2015 with an investment of US\$60 million.⁴⁸

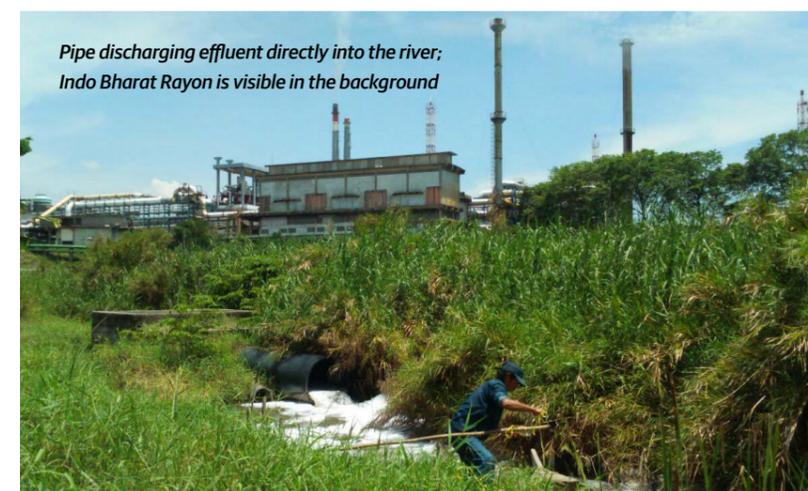
Other Aditya Birla Group textile companies in West Java include PT Elegant Textile Industry, PT Indo Liberty Textiles and PT Sunrise Bumi Textiles. It also operates a factory producing carbon disulphide, PT Indo Raya Kimia.⁴⁹

3.3 Aditya Birla Group's approach to sustainability

Aditya Birla Group presents itself as a company with an ambitious eco-friendly vision and sustainable consumer products. Its vision for 2017 was to become the "leading Indian conglomerate for sustainable business practices across its global operations".⁵⁰ In line with this, the group promotes its viscose as a product that "adheres to the highest levels of safety and purity standards", and is produced "with minimal environmental impact".⁵¹ However, our research indicates that the company is failing to live up to these high standards and despite its membership of numerous sustainability initiatives and certification schemes its environmental and social performance leaves much to be desired.

Aditya Birla is addressing sustainability concerns specific to the raw materials stage of the viscose supply chain by engaging with the Canadian NGO Canopy Planet which through its CanopyStyle initiative has partnered with over 100 fashion brands to eliminate the sourcing of wood from ancient and endangered

forests and other controversial sources for the production of pulp. In 2017, Aditya Birla was ranked first in Canopy's Hot Button Report⁵² for minimising the risk of unsustainable sourcing. The report ranks eleven viscose rayon producers representing 70% of global viscose production. In June 2017, the company completed their first annual CanopyStyle audits of their global sourcing practices comprising a desktop review, site visits of mills in China, India and Indonesia, and a forest field evaluation of their mills in Sweden to verify that local operations are consistent with global sourcing standards. CanopyStyle does not include any criteria on manufacturing nor any obligations for brands to be transparent with regard to the factories from which they source their viscose fibre.



Pipe discharging effluent directly into the river; Indo Bharat Rayon is visible in the background

Some of Aditya Birla's joint ventures, which supply wood pulp to its subsidiaries, are certified by different certification systems; Domsjö Fabriker and its wood procurement subsidiary, Domsjö Fiber, have been certified according to both the FSC, which is the certification scheme endorsed by the CanopyStyle commitment, and the PEFC since 2015.⁵³ AV Nackawic and AV Cell, which are part of AV Group, have been certified compliant under the Sustainable Forestry Initiative (SFI).⁵⁴ Sappi, which supplies pulp for the production of Birla cellulose, complies with a range of forest certification systems such as FSC, PEFC and SFI.⁵⁵ According to Aditya Birla's 2016 Sustainability report,⁵⁶ all of its Pulp and Fibre business units are implementing ISO 14001, a family of standards related to environmental management, and ISO 9001, a set of criteria for a quality management system. ISO certification is used by many companies to legitimise their environmental performance. However, ISO 14001 focuses more on the process than on the results, therefore subscribing to it does not necessarily imply a substantive environmental commitment or bring about significant

improvement in environmental performance.⁵⁷ Aditya Birla also states that all of its units are certified with the Oeko-TEX Standard 100, a textile industry certification for the screening of harmful substances used in consumer textiles. Most facilities also have occupational health and safety management systems, such as OHSAS 18001 and SA 8000. For example, Grasim's Indo Bharat Rayon plant in Indonesia featured in this report was the first to achieve ISO 9002 and ISO 14001 certifications as well as the OEKO-TEX certification in Indonesia.⁵⁸

Birla Cellulose is a part of the Sustainable Apparel Coalition (SAC), a group comprising over 100 brands, retailers, suppliers, NGOs, and non-profit organisations. SAC has developed the Higg Index, a set of tools that are used to evaluate the environmental impact of apparel and footwear products. However, the Higg Index is a self-assessment tool, and while it provides the option of third-party verification, it is left up to companies to decide whether to make the results public. For example, as a member of the SAC, Aditya Birla will need to report under the recently-introduced Facility Environmental Module (FEM 3.0) and have the results independently verified but it is unclear whether these will be made publicly available.

Aditya Birla also has a Group Corporate Social Responsibility (CSR) strategy. This is implemented through the Aditya Birla Centre for Community Initiatives and Rural Development, which targets communities living in the vicinity of their manufacturing plants through rural development activities (education, health care, infrastructure development, etc.). The Group spends approximately US\$39 million (250 crore rupees) annually on its projects, which includes the running of Birla's 20 hospitals and 56 schools.⁵⁹ While this could be seen as illustrating the positive role Aditya Birla plays in local communities, it also demonstrates the company's undue influence and control over local institutions and according to the local Right to Information (RTI) activist, Abhay Chopra, labour unions.⁶⁰

Investors and partners

A number of investors with high environmental, social and governance (ESG) standards have invested in Grasim Industries. According to our research, these include Danske Invest, Norges Bank Investment Management (NBIM), The

Northern Trust, Standard Life Aberdeen, Swedish Länsförsäkrings Fund Management, and Sweden's AP7 pension fund.

BOX 3: Swedish partnership with Aditya Birla

In 2017, the Swedish government announced plans to engage in a strategic partnership with Aditya Birla as part of its effort to increase bilateral trade with India. Sweden, which is India's 19th largest trade partner, is a major exporter of wood pulp to the country. This announcement followed the Aditya Birla Group's acquisition of Swedish speciality pulp and bio-refinery company, Domsjö, which prides itself on being based on 'sustainable Swedish forestry'⁶¹, in 2011. Domsjö is one of five pulp mills that supply the viscose giant;⁶² it also contributes to the group's 'green' reputation.

Sweden is now keen to increase cooperation with the company in the area of 'smart textiles' to explore the use of 'viscose staple fibre, cellulosic fibre and pulp as an alternative to cotton'. During his visit to India in November 2017, Sweden's Minister for Enterprises and Innovation and Rural Affairs, Sven-Erik Bucht, said the talks could result in a joint project between Domsjö and the Birla Group, along with the Swedish and Indian governments.⁶³ If the talks result in a memorandum of understanding, Sweden will be strengthening its ties with a company beset by allegations about pollution at its sites in India and Indonesia.⁶⁴

Toxic stream of water in vicinity of Grasim Industries, Nagda



4. View from the ground: India and Indonesia

In November and December 2017, our investigation teams visited two of Aditya Birla's viscose fibre manufacturing plants: Grasim Industries Ltd.'s plant in Madhya Pradesh, India, and PT. IBR in West Java, Indonesia. This was organised as a follow-up to an investigation in spring 2017, which highlighted devastating environmental and human health impacts surrounding the two viscose production sites. The results of the earlier investigation were published in Changing Markets' *Dirty Fashion* report in June 2017.⁶⁵

Following engagement with representatives of Aditya Birla Group in late 2017 regarding measures needed to remediate the situation, the purpose of the investigation was to observe any changes on the ground since the publication of *Dirty Fashion*. Provided with this brief, our investigation teams set out to inspect current conditions around the factories and in residential areas, and to document effects on local people and the environment. In light of the company's rejection of the findings presented in *Dirty Fashion* and consistent refusal to accept responsibility, the investigation teams were also tasked with securing evidence of pollution; to this end, they collected air, water and soil samples at key locations surrounding the two viscose fibre production plants and in nearby villages. Secondary evidence

of pollution at these sites was gathered through an in-depth review of national and international media reports, government announcements and penalties.

4.1. Grasim Industries, Birlagram, India

Grasim Industries' viscose factory is situated on the Birlagram Industrial Estate in Nagda, Madhya Pradesh. Birlagram is a large industrial site founded by the Birla family in 1954. It stretches over about 8.48 hectares of land on the banks of the Chambal River, which feeds into the Yamuna River, a key tributary to the sacred Ganges. The industrial estate comprises nine manufacturing plants, some of which are ancillaries to Grasim Industries: Grasim Viscose Staple Fibre Division, Grasim Chemicals Division, Grasim Engineering Division, Grasim Chlorinated Paraffin Wax Division, German chemicals giant Lanxess (which according to the accounts from the ground acquired Birla's Gwalior Chemical Industries Ltd. in 2009),⁶⁶ Swiss-owned Clariant Chemicals and US-owned Gulbrandsen Catalysts (formerly Acril Catalysts) also have manufacturing operations there. These factories manufacture products ranging from viscose, agrochemicals, pharmaceuticals, dyestuffs, caustic soda, aluminium chloride, antiperspirant actives and glass coatings through to chemical reagents.

Grasim's viscose manufacturing plant is the oldest and largest factory in the complex. According to local people, the 'Grasim Company' (the term people use to refer to Birlagram) is responsible for most pollution in the area. Our investigators were told that plants within the estate are failing to implement basic pollution-control measures.

Our investigation confirmed that Birlagram does not employ appropriate waste-management systems across the industrial

estate. Many of the factories observed at Birlagram are very old, with ageing machinery showing signs of poor maintenance and repair. While the larger, more modern plants on the estate have their own wastewater treatment facilities, our investigation found that many others simply discharge their untreated wastewater into the system of open roadside drains, or the impaired underground pipeline network.

4.1.1. Summary of findings

Downstream of the Grasim plant, pollution from Birlagram has affected 14 villages on both sides of the Chambal River. The investigation team visited three villages surrounding Grasim Industries: Parmarkhedhi, Gidgarh and Kilodya. Parmarkhedhi and Gidgarh lie about 8km downstream of the plant on the banks of the Chambal River; Parmarkhedhi is situated on the opposite bank of the river, while Gidgarh is on the same side as Grasim. Kilodya is located just downstream of Parmarkhedhi. The investigation revealed the following:

- Conditions on the ground were markedly worse than during our previous investigation in spring 2017. More sites were characterised by visible and highly odorous pollution, which had turned the water dark red.
- There was a major health incident in October 2017, which resulted in the death of two residents of Parmarkhedhi, a village 8km downstream of Grasim Industries on the opposite bank of the Chambal River. Sixty villagers fell seriously ill and lost the ability to walk. Locals claim the incident was caused by contaminated water originating from the Birlagram industrial estate, where the Grasim viscose plant is located (although Birla has denied these claims). Following local pressure, Grasim Industries provided a limited supply of drinking water tankers and health assistance.
- An independent laboratory's testing of an air sample taken outside the Grasim plant found that the level of carbon disulphide was 125 times the World Health Organization's (WHO) guideline value.⁶⁷ Carbon disulphide is a dangerous chemical; it impacts the nervous system and is suspected of damaging fertility and the unborn child, even at low concentrations.⁶⁸
- Contamination has left the villages surrounding Grasim Industries without access to drinking water. In several villages, well water has made people and animals sick, forcing local residents to look for safe and clean water sources

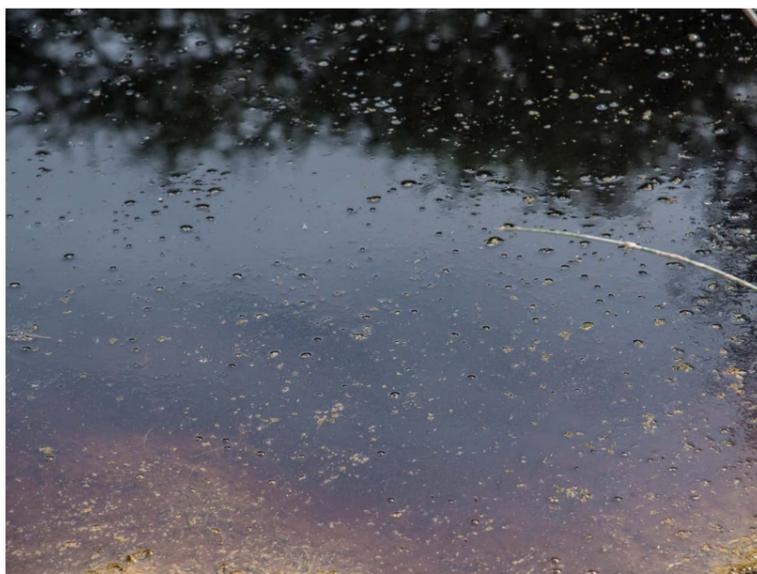
outside their villages.

- People in communities surrounding the factory are suffering from serious health issues, including cancer, tuberculosis, reproductive problems, birth defects and stomach disorders.
- Contaminated water has wiped out most forms of agriculture in the area surrounding the Birlagram industrial estate, and farmers are only able to grow wheat. Farmers are unable to obtain a fair price for their produce at local markets because of fears it is contaminated.
- Various local sources report alarmingly poor worker safety within the Grasim plant, with repeated accidents and deaths in the workplace.

4.1.2. Contaminated water

Grasim's annual report for 2016 states the company has adopted a 'Continuous Effluent Monitoring System' through which they constantly monitor the pH, suspended solids, biochemical oxygen demand (BOD) and COD of treated effluent. They claim their alert system warns them of any deviation in parameters, which results in rapid preventative action.⁶⁹

However, according to people living in the vicinity of the Grasim plant, contaminated water is the main threat to health, agriculture and livelihoods in the area. Villagers from Kilodya say the water in the area has been polluted as far back as they can remember, while residents of adjacent Gidgarh add that their water is red, smells of sewage and leaves a white salt-like residue on the ground. Our investigators were told: 'No one drinks it, not even the animals and birds'. Locals from Gidgarh complain that the river water has been polluted for more than 25 years, and now the water quality has seriously deteriorated. In 2004, Gidgarh's well water became unusable.



Pool of polluted water found downstream of Birlagram in Nagda

Locals underlined that, besides Grasim Industries, other polluting factories within the Birlagram industrial estate share some of the blame for the pollution, such as Lanxess (which manufactures speciality chemicals for agrochemicals, pharmaceuticals, and dyestuffs)⁷⁰ and Clariant (which also produces pigments).⁷¹ However, the investigation team heard that Lanxess had recently stopped releasing its effluent into the river and was transporting it to an unknown waste disposal facility. Many locals also stressed that the red water was present even before the Lanxess plant was established at Nagda in 2009.

Official records also demonstrate Grasim Industries' contribution to Nagda's pollution problem. In September 2017, India's Central Pollution Control Board (CPCB) issued a closure notice to Grasim as a result of non-compliance in relation to manufacturing discharges.⁷² This highlighted that water samples taken at the outlet from the VSF division's effluent treatment plant exceeded prescribed limits for lead and BOD. In addition, water samples taken by CPCB officials during an inspection visit showed levels of COD, BOD and suspended solids exceeding permitted limits in water sampled at the outlet from the chemical division's sewage treatment plant. High levels of COD and BOD mean less oxygen is available in the river for aquatic organisms, such as fish, resulting in their death. Similarly, excessive suspended solids can impair water quality for aquatic and human life.⁷³

The CPCB identifies Grasim Industries as 'one of the highly polluting industries which have been discharging environmental pollutants directly or indirectly into the ambient air and water, having potential threat to cause adverse effect on the water and air quality'. However, the closure notice was subsequently lifted, and the unit was allowed to resume operations at the end of October 2017, with the proviso that Grasim submit a 'performance adequacy report' for the effluent treatment plant within 30 days of that date.⁷⁴

Local member of parliament (MP), Chintamani Malviya, disclosed in a video interview (available on Twitter)⁷⁵ that Grasim Industries' pollution has severely impacted the water, forests and land. He notes that, while the Chambal River is the main source of water for Grasim, the company also releases its effluents into the same river. According to Malviya, pollution generated by the company has reached beyond Nagda-Ujjain all the way to Murbhind-Morena.

On the ground, our investigators observed visible and highly odorous pollution. This had turned the water dark red in ditch-

es, streams and drains, stretching from the immediate vicinity of the industrial estate to more than 12km downstream of the factory.

The investigation team did not observe any visible effluent pipes at the factory perimeter, but villagers explained that effluent and sewage are released into the river through underground pipes. The investigators subsequently observed effluent oozing from the ground, presumably from cracked underground pipes.

High levels of zinc were found in the sludge near the factory's main effluent discharge channel (562mg/kg, in comparison to Canadian interim sediment quality guidelines of 123mg/kg⁷⁶) and in the pool of brown stagnant river water right outside Kilodya village. Zinc sulphate is used in standard viscose and modal production. This might indicate that, over a period of time, Grasim Industries has been discharging zinc particulates that have settled in the stream and its outfall to the Chambal River.

Similarly, Grasim seems to be the source of high levels of zinc in the soil at the factory's waste dump, which it uses to dispose of industrial and housekeeping waste. During both trips, men and women were found scavenging on the waste hill, which in itself might present a public health risk. Moreover, investigators observed waste runoff to the Chambal River, which also suggests an environmental risk.

4.1.3. Health conditions

The degradation in water and air quality brought about by industrial pollution has severely impaired quality of life and made water in the area undrinkable for people and animals. Besides serious health issues, including cancer, the endless search for safe and clean water has become a heavy burden for local people. Media reports have also highlighted these issues,⁷⁷ noting that toxic wastewater from the Grasim plant has devastated the area over the past 35 years, resulting in birth defects and other diseases within the local population.

One man, who has lived in Parmarkhedhi village for the past 25 years, testified that every person in the village complains of various kinds of skin allergies. He believes this is because they use the contaminated water for bathing. Villagers also emphasise high rates of cancer and report the occurrence of tuberculosis, which is primarily affecting women. Women also suffer from fertility and gynaecological problems. People often fall sick, get stomach disorders and suffer from joint pains.



The lack of clean drinking water has also significantly impacted the health of residents of the villages of Kilodya and Gidgarh, which lie on the opposite bank of the Chambal River. Our investigators were told: *'Even the cattle get blisters in their mouth when they drink this water'*. Fetching water for households is a huge burden for Gidgarh women, who, for a family of more than ten people, carry approximately 60 litres of water every day for several kilometres on foot. Similarly, residents of Kilodya are forced to fetch water from a village about 3km away. What's more, children at the village school are not provided with drinking water, and have to bring it from home instead.

A family visited during last investigation in spring 2017. Children were showing signs of mental and physical deterioration. The family said the water is to blame.



Parmarkhedi women collecting water supplied by Grasim since November 2017, after many people in the village fell ill in October 2017

BOX 4: Major health incident in Parmarkhedi leaves dozens seriously ill and two dead

The residents of Parmarkhedi village, located 8km downstream of Grasim's industries' viscose plant, told our investigators about a troubling event that took place in October 2017. Throughout the month, which coincided with the celebration of the Hindu festival Diwali, dozens of villagers fell gravely ill. A local resident reported that many people were left unable to walk, with some still suffering from lingering after-effects at the time of our investigation two months later. The as-yet-unidentified sickness, which affected most of the village, caused severe limb and joint pain in villagers of all ages. According to the national newspaper *Dainik Bhaskar*, two people died as a result of the incident.⁷⁸ Villagers interviewed by the newspaper and our investigation team drew a direct link between the deaths and contaminated water from Grasim Industries. Medical staff who treated the villagers were also of the view that contaminated water was at the root of the villagers' health problems.

The villagers reported that, during this period, at least ten ambulances were ferrying patients to hospital for two days. The media reported that, of 400 residents who underwent a health check-up, 60 were found to be sick. According to the same source, studies by the health and pollution departments have proven that groundwater in 14 villages downstream of the Grasim plant is severely polluted. The article also reports that Congress District General Secretary, Dalip Singh Gurjar, has demanded Grasim Industries takes responsibility for the pollution impacts on villages and local residents.⁷⁹

In response to these allegations, Aditya Birla representatives told Changing Markets the locals fell sick due to viral infection, as was claimed by the Block Medical Officer who organised medical check-ups in the same media report.⁸⁰ They also argue that the death of two people, aged 20 and 25, was due to chronic cardiorespiratory disease and tuberculosis, unrelated to pollution caused by Grasim Industries.

Villagers testified that the mass hospitalisation took place on the initiative of a concerned local doctor, who organised the ambulances upon hearing of the incident. He also set up a 'health camp' to treat affected people. According to the local residents, despite their suspicions that the incident was related to industrial pollution, no one from Grasim Industries provided immediate help: *'They did nothing to assist us'*.

In response to this incident, Grasim Industries took a decision to supply drinking water to Parmarkhedi village. However, according to residents' testimonies, the company provides a mere three tankers of water every day, falling far short of villagers' needs and offering scant recompense for the damage caused. One man from Parmarkhedi village complained: *'After they have destroyed everything, what is the point of giving us drinking water? We cannot live on water alone. We have no food. Our agriculture, which was our main sustenance, has been completely destroyed'*. What's more, according to the same villager, the tankers - which were delivered regularly at first - are not so frequent any more, meaning they need to seek alternative sources of water outside the village.

A month after the incident, in November 2017, Grasim sponsored a community medical check-up, and free medicine was distributed. However, the company has failed to take any further action to tackle the pollution and health issues affecting local people, or to remediate the environmental impacts.

In the meantime, other villages (including Gidgarh and Kilodya) have not received any compensation. However, they admit they were not as badly affected as Parmarkhedi: *'If we were drinking the same water we would have also had the same fate'*. The locals also point out that providing the occasional tank of water will not solve the systemic problems, which have resulted from decades of pollution: it will not cure their acute and chronic health problems, end their hunger or reverse the destruction of their agricultural lands.

4.1.4. Fluorosis

Our spring 2017 investigation showed cases of cancer and birth defects are common in the Birlagram area, and have been reported in the local media on numerous occasions.⁸¹ The *Dirty Fashion* report highlighted the case of the family of a soybean farmer, whose three children began showing signs of mental and physical deterioration between the ages of 10 and 12. Now aged 16 to 20, all three are disabled. The family blames the contaminated water for their plight; Aditya Birla responded to the allegation by arguing that birth defects in Parmarkhedhi are a result of the presence of fluoride in soil, and have nothing to do with the viscose plant.

Fluorosis is a chronic condition caused by the excessive intake of fluorine compounds during the first eight years of life. The condition affects the teeth, causing discolouration and surface irregularities.⁸² Skeletal fluorosis also affects the bones and major joints of the body, resulting in severe pain, rigidity or stiffness in joints. Severe forms of skeletal fluorosis result in significant disability.⁸³

Data on the occurrence of fluoride in Nagda is contradictory. Aditya Birla sent Changing Markets a Water Aid India Report from 2005, which indicates higher fluoride in ground water in the region. However, a 2006 CPCB report on fluoride-contaminated areas in Madhya Pradesh fails to identify Nagda as one of them.⁸⁴ Another report on the wider Ujjain District, published by the Bhopal-based Central Ground Water Board regional office in 2013, found a range of fluoride concentrations: from below to slightly above permissible drinking water standards⁸⁵ (0.45mg/l to 1.88mg/l, in comparison to the Indian permissible drinking water standards of 1.0mg/l to 1.5mg/l).⁸⁶

Our investigators tested water samples for fluoride at the various points. However, most samples contained no detectable fluoride, and where samples did contain it, it was below levels of concern. A doctor also told investigators that the illnesses observed in Nagda do not resemble fluorosis.

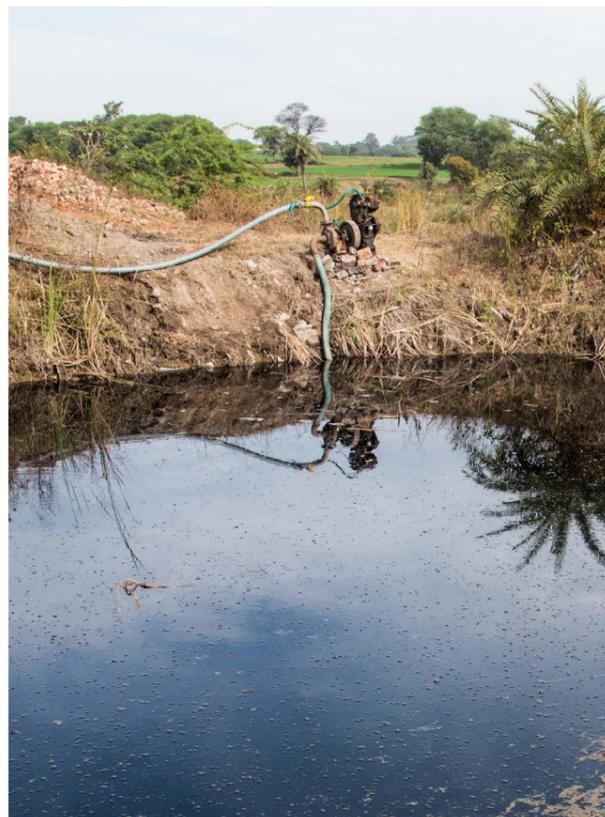
4.1.5. Impacts on agriculture

Contaminated water has acutely affected agriculture and crops in the areas surrounding Grasim Industries. Several local residents from Parmarkhedhi, Gidgarh and Kilodya testified that agriculture in the area has been devastated by years of pollution, and that nothing will grow except wheat. On the fields inland from the Chambal, which are irrigated by lake water, it is easy to grow a wide variety of crops; but in the area surrounding

Grasim Industries, they explain, the soybean crop was wiped out in 2017 because they were forced to irrigate it with the contaminated water. A villager from Parmarkhedhi testified: *'We can't dream of growing vegetables or fruits in the village. Nothing grows on this land.'*

In addition, farmers are unable to get a fair price for their produce when they try to sell it at the markets in Nagda, Ujjain and Ratlam, because buyers perceive it to be contaminated. Many farmers state the wheat produced in their fields lacks taste and is of low quality. As a result, farmers from Parmarkhedhi, Bhagatpuri, Gidgarh and Kilodya obtain about US\$3 to US\$5 (200 to 300 rupees) less than the government price per quintal - a loss of almost a quarter of the average wheat purchase price on the market (US\$23 per quintal).⁸⁷ Sometimes, they can't even sell the crops, because people are reluctant to buy food produced using 'dirty water'.

Despite this, in its annual report Grasim claims effluent treated at its facility is used to irrigate fields, and *'farmers are being constantly motivated to use the same for improving crop yields'*.⁸⁸



Agricultural pump using toxic water for irrigation of farms. 14 villages downstream of Birlagram industrial estate have no choice but to use polluted water

4.1.6. Air pollution

Villages surrounding Grasim Industries have endured heavy air pollution for as long as they can recall. Locals still complain about the stench of rotten eggs and radishes, which indicates the presence of carbon disulphide and hydrogen sulphide; Parmarkhedhi residents refer to it as *'gas'*. Our investigators noted that the stench was less noticeable than during the previous investigation in spring 2017, but locals said it is at its worst at night and early in the morning, when it is unbearable and causes nausea. They complained that it is hard for visitors to endure, and that visiting relatives rarely stay for more than a day. Villagers from Gidgarh and Parmarkhedhi believe the noxious gas is also to blame for destroying their crops. Locals also associated intense smells with a leak, meaning an intentional discharge of waste gas from Grasim Industries. They claimed intentional leaks are common practice by the factories.

In its 2016 annual report, Grasim claims the company monitors emissions and ensures discharges are under control through its online monitoring systems (online continuous ambient air quality monitoring, emission monitoring and discharge monitoring of suspended particulate matter, sulphur oxides and nitrogen oxides). According to Grasim, all emission sources have Efficient Air Pollution Control Equipment installed, and *'the stack and ambient air quality is well within the prescribed limits'*.⁸⁹ In their response to Changing Markets in September 2017, Aditya Birla claimed the level of emissions is regularly checked and remains perfectly within norms.

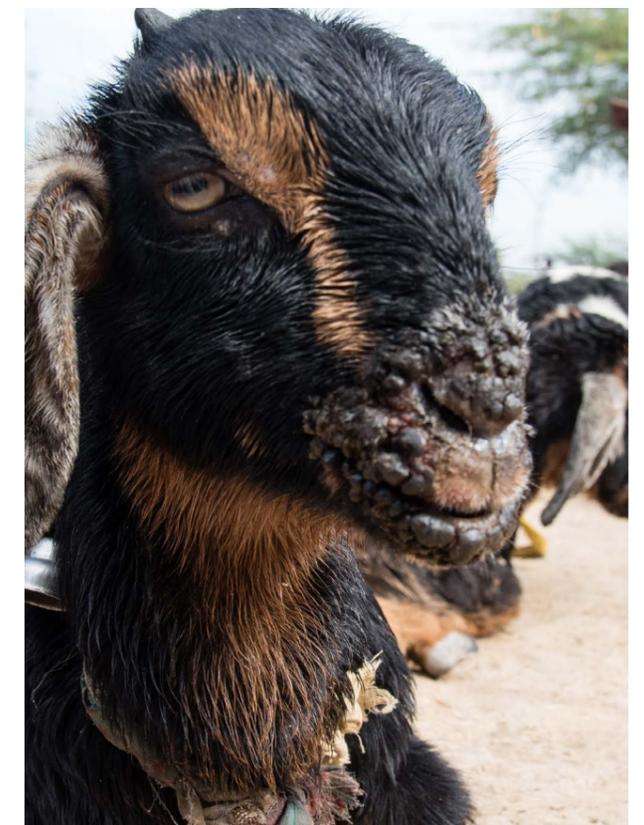
However, the CPCB's closure notice issued to Grasim Industries in September 2017 (see section 4.1.2.) highlighted that air emissions of sulphur dioxide (SO₂) at Grasim's VSF division exceeded prescribed limits from a chimney (*'stack'*), casting doubt on the credibility of Grasim's assertions.

Our own findings from one air sample, taken outside Grasim Industries premises along the factory wall in December 2017, show the level of carbon disulphide was 125 times the WHO's guideline value⁹⁰ (2,500µg/m³, in comparison to a guideline value of 20µg/m³). For comparison, the lowest concentration of carbon disulphide at which an adverse effect was observed is 1,000µg/m³ in the general environment. The WHO therefore recommends a guideline value of 100µg/m³, with an average exposure time of 24 hours. Considering the sensory effects of odour precipitation of carbon disulphide, a guideline value of 20µg/m³ is set for an average time of 30 minutes. The level measured around Grasim's viscose fibre plant is also above the US Environmental Protection Agency's Inhalation Reference

Concentration for carbon disulphide⁹¹ (700µg/m³), which is based on neurological effects in humans.

It would be necessary to monitor carbon disulphide levels over a longer time period to establish whether the concentration detected is representative of longer-term concentrations and exposures. Still, it is alarming to find any significant levels of carbon disulphide outside the factory, or even outside the immediate area of use within the factory. This is because carbon disulphide, like all volatile organic compounds, diffuses quickly in the open atmosphere, meaning that concentrations reduce very quickly with distance from the source. The positive result on the road outside the factory suggests a significant source, likely fugitive emissions, inside the factory.

The concentration detected here would seem to explain the stench and sickening effect of Nagda's polluted air. It could also account for more severe health impacts associated with carbon disulphide, which are prevalent in the local population, including nausea, vomiting, muscle pain, reproductive effects, birth defects and chronic skin conditions, to name a few. Exposure to higher concentrations would have more far-reaching health impacts, as explained in Box 5.



Animals drinking contaminated water in Nagda frequently fall ill



BOX 5: Carbon disulphide

Carbon disulphide (CS₂) is a highly volatile liquid characterised by its unpleasant odour, reminiscent of rotting radishes.⁹² It is identified as a Hazardous Air Pollutant under the US Clean Air Act,⁹³ is highly flammable and may cause fire or explosion. Because of its high toxicity and flammability, and low flash point, its use in chemical manufacturing has been discouraged and has significantly diminished in the West. Unfortunately, it appears to be essential in viscose manufacturing, as no suitable substitute has been found yet to replace it. Viscose manufacturing is by far its largest end-use, reportedly representing up to 75% of the world's production of CS₂.⁹⁴ While the 'lyocell' method of cellulose fibre regeneration does not require CS₂, fashion brands and designers claim viscose has different properties to lyocell, and therefore the two fibres are not interchangeable.

CS₂ has a very low acceptable exposure threshold. Emissions should therefore be confined to production facilities, with workers wearing adequate protective gear at all times. However, research has shown that viscose plants are a major source of CS₂ emissions to ambient air outside viscose plants, and consequently of exposure for people living nearby. CS₂ is absorbed not only by inhalation but also via the skin.⁹⁵

Exposure of viscose factory workers and locals to CS₂ has been reported to lead to severe health issues, including Parkinsonism, heart attack and stroke. Workers in viscose factories suffer the most severe health impacts. At high exposure levels, the chemical impacts the nervous system, causing neurological and psychiatric symptoms. Even at lower concentrations or through long-term exposure, coronary heart disease, neurobehavioural disorders and psychological disturbances are reported.⁹⁶ It has also been linked with reproductive and developmental toxicity,⁹⁷ meaning that people inhaling it have been known to suffer reproductive effects, such as decreased sperm count, decreased fertility, miscarriage or menstrual disturbances.

Our investigation revealed that local residents around the factories often report leaks, accidental releases or improper management of CS₂ from viscose production facilities, putting locals in harm's way. Such short-term exposure through inhalation has been reported to cause changes in breathing and chest pains, as well as nausea, vomiting, dizziness, fatigue, headache, blurred vision and delirium.⁹⁸ The lowest concentration of CS₂ at which an adverse effect was observed is around 1,000µg/m³ in the general environment.⁹⁹

Owing to the health and safety hazards associated with CS₂, it is imperative that viscose plants employ appropriate safety measures for the protection of workers and handling of this dangerous chemical. It is also key that CS₂ is recovered at the end of the production process. The use of a 'closed-loop' process means CS₂ and other chemicals used in production are captured and reused, instead of being released into the environment, and the use of toxic chemicals is minimised or eradicated entirely at source.

4.1.7. Worker safety: 'one death per month'

Our investigation recorded high levels of concern about worker safety at Grasim Industries' viscose plant. Locals speak of frequent accidents and even deaths at the factory, where workers have reportedly died of suffocation (asphyxiation), heart attacks or toxic spills.

In his aforementioned Twitter testimony, MP Chintamani Malviya revealed that due to unsafe working conditions, cases of heart and skin diseases are common among workers. He also claimed there are long-standing reports that one Grasim worker dies every month, and argued that Grasim's management is not paying attention to this issue.

In December 2016, MP Malviya raised the issue of Grasim Industries' negligence before the Indian Parliament (*Lok Sabha*), in the wake of the death of a labourer and frequent casualties at Grasim. A poisonous gas leak at the factory in October 2016 caused the death of a 40-year-old worker, Hariom, and affected ten other workers. MP Malviya demanded strict action be taken and a probe committee investigation.¹⁰⁰

The investigation found that Grasim commonly hires contract labourers from other states (e.g. West Bengal, Uttar Pradesh and Rajasthan) to carry out the most hazardous jobs. These workers don't have strong ties or family links within the local community, and therefore cannot count on local people's support if they are poorly treated or afflicted by work-related health problems.

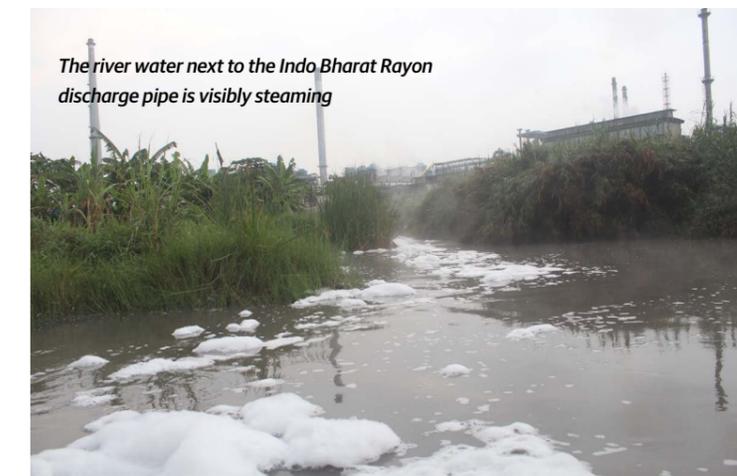
Our investigators also found contract labourers taking their own safety shoes and helmets to work, or purchasing them from a local stand in front of the industrial complex, indicating that Grasim is failing to provide even basic safety equipment to its workforce.

4.2. PT. Indo Bharat Rayon, Indonesia

4.2.1. Summary of findings

The investigation around Aditya Birla's IBR plant in Purwakarta, West Java took place in November 2017. It took in the manufacturing site itself and three nearby villages on the banks of the Citarum River: Kampung Sawah, Kampung Sukamulya and Kampung Cilele Tegalega. Kampung Sawah is located between IBR and another viscose plant, Lenzing's South Pacific Viscose, although it is closer to IBR. The road into the village runs right

alongside the walls of IBR. This plant was also visited during our previous investigation in April 2017. Kampung Sukamulya is located downstream from IBR along the Cikareng River, closer to IBR's waste discharge point. Kampung Cilele Tegalega is situated on the opposite bank of the river and technically located in Karawang district. The Citarum River, where IBR discharges its wastewater, is one of the most polluted rivers in the world, contaminated predominantly by effluent from the textile industry.¹⁰¹



The river water next to the Indo Bharat Rayon discharge pipe is visibly steaming

The investigation revealed the following key findings:

- Locals report regularly witnessing evidence of illegal discharges by IBR, usually at night-time or after rainfall.
- Our investigators, who visited the plant during daylight hours, observed discharge coming from IBR, which was steaming hot and accompanied by thick foam.
- An independent laboratory's testing of water samples showed that the river water around the IBR discharge pipe is extremely polluted and does not even comply with 'worst-in-class' Indonesian water quality standards, meaning it should not even be used for irrigation, let alone drinking or bathing.
- Children were seen bathing in the contaminated water close to the discharge pipe, and farmers were found to be using the river water for irrigation and fish farming;
- The villagers' complaints seem to be falling on deaf ears, and Aditya Birla Group lacks a credible grievance pro-

cedure to properly acknowledge and address local concerns and complaints.

4.2.2. Water pollution

Local residents allege that the IBR plant, which is situated on the banks of the Citarum, regularly releases untreated wastewater into the river. Several people living and working in the area claimed to have seen first-hand evidence of IBR illegally dumping into the river, including discharges of various colours. The boat operators at the ferry crossing in Kampung Sukamulya testified that dumping and waste discharges from the plant are most common either after rainfall or, more often, during the night. Residents of Kampung Sukamulya also testified that in the dry season, when pollution is easier to detect, they observe a milky-white substance coming from the IBR Site.

Our investigators observed for themselves discharge emanating from IBR. This was steaming hot and accompanied by a thick foam, which was visible even some distance from the discharge pipe. COD and total dissolved solids (TDS) values in the water sample, taken from surface and mid-depth water at the factory's discharge pipe, indicate that the water is heavily polluted and fails to achieve 'worst-in-class' water quality standards, as defined under Indonesian regulations (Class IV).¹⁰² This means it should not be used for drinking, recreation, fishery, livestock, irrigation or any other usages requiring a similar quality. It is also not in line with WHO guidelines for drinking water quality, because of the high levels of lead and TDS in the water.¹⁰³

Despite this, locals regularly use the Citarum for bathing and drinking water, as well as for agricultural purposes, and our in-

vestigators found children running and playing naked in the river water. In both Kampung Sawah and Kampung Sukamulya, rice fields extend right up to the factory walls, and are irrigated by river water. Villagers did not report any recent decline in crop yields as a result of pollution, but this is perhaps not surprising in light of how long the local area has been affected by industrial activities. Our investigation team also came across several fish-farming ponds located near the factory perimeter in Kampung Sukamulya, which were using polluted river water.

4.2.3. Government and company action

During our previous investigation, local NGOs emphasised a significant lack of government inspection capacity in the region. According to Greenpeace Indonesia, only two officials have the authority to inspect factories in West Java. This clearly points to a lack of government personnel and resources when it comes to monitoring the impacts of industrial activity on the ground.

Aditya Birla responded that government officials '*regularly visit, inspect and audit the plant*'. They provided proof of three inspections that took place at IBR in 2017. Each one focused on different pollution aspects - inspection of landfill management, wastewater management and fly-ash management at the company's power plant - suggesting that each aspect might be inspected once a year or less frequently. In addition, Changing Markets was unable to establish the quality and scope of the inspections on the basis of the documents provided.

Inhabitants of Kampung Sawah revealed IBR supplies water to about half of the village residents. Villagers stated they had received no other form of assistance from IBR in the recent past.



Children bathing directly across from Indo Bharat Rayon discharge pipes

BOX 6: Environmental threats to the Citarum River

The Citarum River is reported to be one of the most polluted rivers in the world. Stretching for 269km, it serves as the main source for the Cirata, Jatiluhur and Saguling reservoirs, which irrigate 400,000 hectares of rice fields along its banks;¹⁰⁴ 15 million people are directly reliant on it for drinking and bathing water.

The water quality of the Citarum River has seriously deteriorated in recent decades, largely due to industrial pollution. While the rise of the textile sector has brought jobs to Indonesia's West Java province, and accounted for almost US\$12 billion in exports in 2016,¹⁰⁵ the industry is also one of the main sources of pollution to the river. According to Greenpeace, it accounts for 68% of industrial facilities on the Upper Citarum.¹⁰⁶ In January 2018, the media reported Indonesian Ministry of Industry figures stating that only 380 of the 440 registered textile producers along the river are equipped with wastewater treatment plants, even though this is a legal requirement.¹⁰⁷



Water was seen flowing from the IBR discharge pipe directly into the Citarum river

In 2013, a report by the Blacksmith Institute and Green Cross Switzerland¹⁰⁸ proclaimed the Citarum the world's dirtiest river, after a study showed that textile producers dump an estimated 280 tonnes of toxic waste into it every day.¹⁰⁹ While there are other sources of industrial emissions in the area, the report points to the dominant role of the textile industry in polluting the Citarum River basin.

These irresponsible practices have partly been enabled by lenient government regulation. According to Greenpeace, the government regulates only a small fraction of the chemicals used for textiles production. In 2013, it regulated a mere 264 of the 100,000 chemicals used in the global textile industry, to which 1,500 new substances are added every year.¹¹⁰

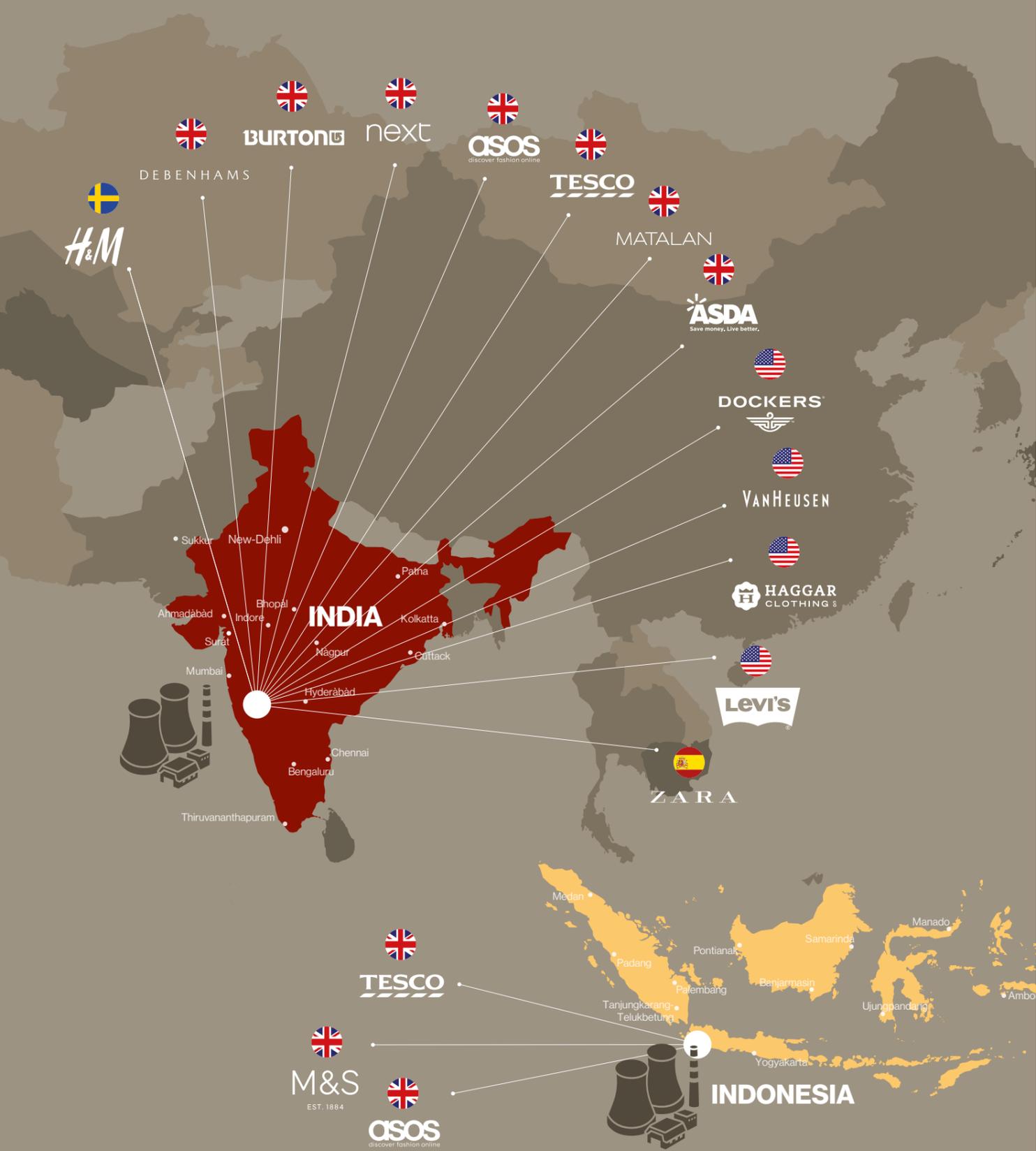
In 2015, local environmental organisations Pawapeling, WALHI and Greenpeace brought a case before the Indonesian Bandung court. The evidence they presented showed that production permits were given to factories without a preliminary study of how their discharges would impact the local ecosystem or requirements for monitoring and evaluation. In May 2016, Bandung court decided to suspend, cancel and revoke government decrees that legalised the pollution generated by three textile factories, which had been releasing untreated wastewater into the Cikijin River, a tributary of the Citarum.¹¹¹

In April 2016, the Coalition Fighting Against Industrial Waste (consisting of the Indonesian Forum for the Environment, Greenpeace Indonesia, Pawapeling and Bandung Legal Aid) released a report alleging that industrial wastewater used for irrigation had contaminated 2,300 acres of rice fields with heavy metals and caused economic losses of about US\$866 million over 20 years.¹¹²

In January 2018, the *Jakarta Globe* reported that a dangerous antibiotic-resistant pathogen had been discovered in the river. According to Coordinating Maritime Affairs Minister, Luhut Binsar Pandjaitan, the bacteria developed as a result of the waste disposal of 146 nearby factories. Because of the threat to marine life and future generations, the Governor of West Java, Ahmad Heryawan, is even considering gradually closing the river, although it is unclear what this will mean in practice.¹¹³

WHICH BRANDS BUY FROM ADITYA BIRLA?

The links shown here are based on information provided directly by fashion brands and retailers as well as information previously available on the Aditya Birla website. They indicate which brands are buying viscose from Aditya Birla and not specific factories featured in this report.



For illustration purposes only. Locations are symbolic and map not to scale.

4.2.4. Waste

In April 2017, our investigators found villagers washing intermediary viscose products in the Citarum River, directly exposing themselves and the river to toxic chemicals contained in the fibre. When they returned in November, no such activity was taking place. According to several men working along the river bank, IBR stopped hiring villagers in Kampung Sawah to process viscose following the publication of the *Dirty Fashion* report.

Aditya Birla responded that sometimes a fibre waste (so-called 'tow') is generated, which is then provided to village communities as a 'community development initiative' or sold to contractors to sell on. It claims that this activity has now stopped, but that while it was taking place the viscose was washed within the premises and therefore safe for use. This contradicts our findings from spring 2017 and photographs from the ground.

Still, in November 2017, our investigators encountered children playing barefoot in areas with leftover viscose bags, sulphur and other visible pollution. Yellow residues, which looked and smelled strongly like sulphur, were still visible in this area, albeit in smaller quantities than during the previous investigation. This could be because the visit took place during the rainy season. Aditya Birla claimed it cannot ascertain the source of such wastes, and that they could be unloaded from boats by waste recyclers, 'who buy from several places, and unload it at river bank'. This seems unlikely, especially given that sulphur is used as a raw material in the viscose industry to make sulphuric acid.

4.2.5. Protests against IBR

People in all three villages said they had observed protests taking place at IBR. The bulk of these were protests over pay by casual labourers from other parts of the country, not locals. However, residents of Kampung Sawah disclosed that the village held a small demonstration in early 2016 to protest against pollution from the IBR plant. According to them, there was no reaction from IBR.

Similarly, residents from Kampung Sukamulya said they attempted to file complaints against IBR, specifically about fly-ash and water pollution, but never received any response. They noted that the government came to the village to conduct testing in 2016, but the locals never saw the results or any further action taking place after that.

In exchanges with Changing Markets in September 2017, Aditya Birla claimed that, in the history of IBR, there had never been any protests for environmental reasons. During a second exchange in February 2018, the group again claimed it was unaware of any complaints regarding air pollution around the IBR plant, noting: 'Our Grievance Process allows for any complaints to be received by our External Affairs (EA) department, who then makes an initial investigation into the complaint and seeks input from the related department of IBR. The EA personnel may visit the village if required.' The company further claimed that a series of village surveys had taken place from July to December 2017, and that the inspection reports were available to consult at the factory itself. The surveys with the villagers were not conducted by an independent third party, but by IBR officials and officials of a government-approved lab. However, no information on the substance or frequency of complaints or grievances was provided, which is very surprising in light of the numerous complaints villagers shared with our investigation team during their visit in November 2017.

The findings presented in this section demonstrate that Aditya Birla Group is not only far from being a sustainability frontrunner but also failing to implement even basic legal requirements regarding the management of its viscose plants. This is highly alarming, considering that the company is one of the leading suppliers of viscose to major European and North American brands, and that it has its sights set on rapid expansion in the near future.

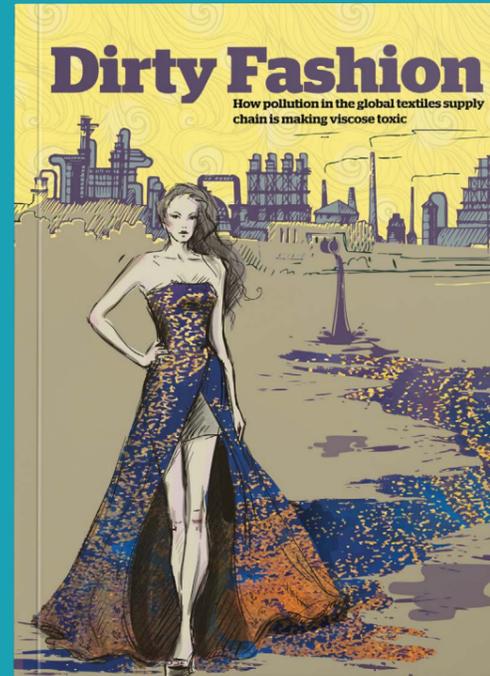
5. Conclusion

BOX 7: Brands react to *Dirty Fashion* report

The *Dirty Fashion* report revealed that many clothing brands and retailers are buying from polluting factories, often without any awareness of the situation on the ground. Several brands, such as H&M, ASOS, and Zara (Inditex), (see infographic) were found to be buying from Aditya Birla Group. As Birla is the world's biggest viscose producer, it likely has many more customers among well-known brands, but as not all brands subscribe to high levels of transparency, Changing Markets had to rely on information that was either publicly available or communicated to us.

Following the publication of *Dirty Fashion*, Changing Markets engaged with many brands and had meetings or calls with H&M, Inditex, ASOS, M&S, Tesco, Gap, Levi's and John Lewis to discuss our findings and what can be done to reduce pollution and improve the situation on the ground. We also reached out to numerous other brands, which either failed to respond or refused to engage, and to a variety of NGOs. Many brands have expressed interest in improving the situation on the ground and gradually adopting higher production standards. As a result of this engagement, Changing Markets researched and wrote the *Roadmap towards responsible viscose and modal fibre manufacturing*, which is published in parallel with this report. Changing Markets asked brands to support the principles outlined in the *Roadmap* and to incorporate the key points related to responsible viscose manufacturing into their own sustainability and responsible sourcing policies. In addition, the *Roadmap* included some general requirements for responsible brands, such as full mapping of their supply chains, transparency about their suppliers and regular independent monitoring of their performance.

The roadmap was developed in consultation with numerous organisations and experts in this field, and represents an ambitious yet realistic and achievable framework for moving the viscose industry towards a more sustainable future. With viscose representing a growing share of global fibre demand, it is very important to set out expectations for any future capacity coming onto the market, while at the same time cleaning up existing factories, starting with those with the highest production volumes.



Aditya Birla Group claims to be committed to sustainability, yet our investigation has revealed the company is responsible for significant pollution at two of its factories in India and Indonesia.

While Aditya Birla seem to be taking commendable steps to tackle viscose raw material sourcing issues, it consistently disregards community calls for action to address problems at the fibre manufacturing stage. Upgrading factories should be much more straightforward than cleaning up forestry supply chains, because production is in full control of factory owners and does not entail a need to work with third parties to the same extent.

To live up to its commitment to its customers and sustainable investors, Birla should stop denying the problem and start working to become part of the solution by engaging with brands, communities and workers. It should move its operations towards closed-loop manufacturing, which significantly reduces environmental emissions and enables the recovery of hazardous chemicals. With viscose representing a growing share of global fibre demand, Aditya Birla needs to act now to clean up its factories and ensure closed-loop production is standard for any new viscose production capacity introduced as a result of its expansion plans.

Our *Roadmap towards responsible viscose and modal fibre manufacturing*, published alongside this report, lists relevant

standards that address pollution in viscose fibre production and concludes that the EU Best Available Technique (BAT) standard (2007) is ambitious, achievable and covers most of the key pollution parameters. Birla should therefore commit to investing in the improvement of its operations in line with this, and according to a concrete and ambitious timeline that identifies key milestones.

This transformation is also wanted by consumers, who expect retailers to act in line with their environmental and social policies, and by retailers and brands, which are turning towards more sustainable choices in fibre selection and taking steps to ensure viscose used in their clothes is produced in a responsible way (see Box 7). By committing to the *Roadmap*, the frontrunner brands are sending a signal to the rest of the industry that the viscose sector can and must move towards a more sustainable future by addressing challenges at both the raw-materials sourcing and manufacturing stages. Committed brands are looking to manufacturers to make this happen.

While other producers, including Austrian producer Lenzing and Chinese producers, are taking measures to move towards sustainable viscose, Aditya Birla Group appears to be turning a blind eye to the issue.

BOX 8: Lenzing takes action in response to the *Dirty Fashion* report

Austrian speciality fibre maker Lenzing, whose Indonesian South Pacific Viscose (SPV) fibre plant featured in the *Dirty Fashion* report, has taken the issues exposed by NGOs seriously and has developed a detailed roadmap to address them.

Lenzing's roadmap for its Indonesian plant (as seen by the Changing Markets Foundation) includes 'implementing a voluntary and ambitious Lenzing Group Standard' for the production of viscose at all sites, and the aim for all its plants - including SPV - to be compliant with the requirements of the EU Ecolabel by 2022. Lenzing has set clear targets for improving specific air and wastewater emissions by upgrading its Indonesian factory to a 'closed-loop' process, which enables the containment and recovery of chemicals such as carbon disulphide. The company also plans to address its safety, health and environmental performance by engaging with various parties, such as multi-stakeholder initiatives, NGOs and an independent auditor.

Discharge pipe from IBR factory in Indonesia



Recommendations

- Birla should transparently report on its emissions levels to air and water, supported by third-party verification, which should include industry-specific parameters such as carbon disulphide and hydrogen sulphide - even if these are not required by national authorities. This transparency is needed for brands and communities to be able to evaluate the progress Birla is making towards achieving its commitment.
- Birla should hire an external auditor to investigate workers' health and safety at its sites and provide recommendations. This auditor should also investigate any potential impacts on local communities and recommend steps to remediate these.
- Birla should establish an independent and transparent grievance mechanism for workers and local communities. As our investigation has revealed, local communities have repeatedly protested and complained about pollution from the company's sites. Although Aditya Birla claims it engages with the community, when this engagement does take place it is conducted by Birla employees, and is therefore neither independent nor transparent; furthermore, there is no disclosure of how complaints or disputes are resolved.
- Brands and retailers can play a very important role in the transformation process by clearly stating their expectations of clean viscose to manufacturers. For more information on this, see our *Roadmap towards responsible viscose and modal fibre manufacturing*.
- The Indian and Indonesian governments should set limits on industry-specific parameters in viscose fibre production and regularly inspect and monitor companies' compliance with national emissions limits for air and water and waste-management practices. They should also strengthen worker safety rules and their enforcement.

1 Birla Cellulose (2018) Message from the top management: Green and global. *Fibre2Fashion*. [ONLINE] Available at: <http://www.fibre2fashion.com/services/promotion/enhanced-sustainability/birlacellulose.asp>.

2 Canopy (2017) *The hot button issue: Detailed matrix of viscose producer performance: 2017 update*. [ONLINE] Available at: <http://canopyplanet.org/wp-content/uploads/2017/11/Canopy-Hot-Button-Matrix-EN.pdf>.

3 Aditya Birla Group (2018) *Grasim Industries Limited*. [ONLINE] Available at: <http://www.adityabirla.com/businesses/Profile/Grasim-Industries-Limited>.

4 Birla, K.M. (2016) *The Aditya Birla Group sustainability vision*. [ONLINE] Available at: <https://sustainability.adityabirla.com>.

5 Aditya Birla Group (2017) *Birla Cellulose is number one globally for its commitment to sustainable forestry management*. Press Release, 8 November. [ONLINE] Available at: <http://www.adityabirla.com/media/press-releases/birla-cellulose-is-number-one-globally-for-its-commitment-to-sustainable-forestry-management>.

6 World Health Organization (WHO) (2000) Chapter 5.4: Carbon disulfide. *Air Quality Guidelines: 2nd edition*. Copenhagen: WHO Regional Office for Europe. [ONLINE] Available at: http://www.euro.who.int/_data/assets/pdf_file/0019/123058/AQG2ndEd_5_4carbodisulfide.PDF.

7 European Chemicals Agency (ECHA) (n.d.) *Substance information: Carbon disulphide*. [ONLINE] Available at: <https://echa.europa.eu/substance-information/-/substanceinfo/100.000.767>.

8 Named the Collaboration for Sustainable Development of Viscose (CV), the initiative brings together China's largest viscose producers in partnership with China Chemical Fibre Association and China Cotton Textile Association. It remains to be seen what level of ambition this initiative will set, but it comes at a time when the Chinese government has considerably stepped up its efforts to regulate polluting industries and introduce greater transparency into textile supply chains (including companies that persist in violating pollution norms) via the Institute of Public & Environmental Affairs' online platform. This is putting additional pressure on companies to improve their environmental performance. See: <http://www.ipe.org.cn>.

9 Textile Exchange (2016) *Preferred fibre market report 2016*. [ONLINE] Available at: <http://textileexchange.org/wp-content/uploads/2017/02/TE-Preferred-Fiber-Market-Report-Oct2016-1.pdf>.

10 Paul Blanc, 2016, *Fake Silk – The Lethal History of Viscose Rayon*, Yale University Press, p.viii.

11 Changing Markets (2017) *Dirty Fashion. How pollution in the global textiles supply chain is making viscose toxic*. [ONLINE] Available at: <https://changingmarkets.org/portfolio/dirty-fashion/>.

12 Cheeseman, G.M. (2015) World's largest supplier of Rayon commits to sustainable sourcing. *Triple Pundit*, 8 May. [ONLINE] Available at: <https://www.triplepundit.com/2015/05/worlds-largest-supplier-rayon-commits-sustainable-sourcing/>.

13 Aditya Birla Group (2017) *Grasim Industries annual report 2016-17*. [ONLINE] Available at: http://www.grasim.net/investors/downloads/Grasim_Industries_annual_report_2016-17.pdf.

14 SWICOFIL (2015) *Viscose rayon*. [ONLINE] Available at: <http://www.swicofil.com/products/200viscose.html>.

15 Ethical Fashion Forum (2016) *Future fibres sourcing report*. [ONLINE] Available at: <http://source.ethicalfashionforum.com/article/future-fibres-sourcing-report>.

16 WHO Regional Office for Europe, 2000, *Air Quality Guidelines – Second Edition, Chapter 5.4 Carbon Disulphide*, http://www.euro.who.int/_data/assets/pdf_file/0019/123058/AQG2ndEd_5_4carbodisulfide.PDF

17 Klemmer et al., 2000, Carbon disulfide nephropathy, *Am J Kidney Dis*. 2000 Sep;36(3):626-9

18 Patel et al., 2004, Male exposure mediated adverse reproductive-outcomes in carbon disulphide exposed rayon workers, *J Environ Biol*. 2004 Oct;25(4):413-8.

19 Changing Markets (2017) *Dirty Fashion. How pollution in the global textiles supply chain is making viscose toxic*. [ONLINE] Available at: <https://changingmarkets.org/portfolio/dirty-fashion/>.

20 Pharos project, Hazardous to the aquatic environment (acute) – Category 2, <https://www.pharosproject.net/hazard/hazard/show/620>, <https://www.pharosproject.net/material/show/2007102>

21 Youlong Qiu. Environmental Protection Objectives of China and the Impact on the Chinese Viscose Fiber Industry [A] *China Textile*

Leader, 2013 No.10

22 Mordor Intelligence (2017) Global viscose staple fibre market – segmented by production process, application, and geography – growth, trends and forecasts (2016–2021), Hyderabad.

23 Textile World (2015) *Man-made fibers continue to grow*, 3 February. [ONLINE] Available at: <http://www.textileworld.com/textile-world/fiber-world/2015/02/man-made-fibers-continue-to-grow/>.

24 Global Fashion Agenda & The Boston Consulting Group (2017) Pulse of the Fashion Industry. [ONLINE] Available at: https://www.copenhagenfashionsummit.com/wp-content/uploads/2017/05/Pulse-of-the-Fashion-Industry_2017.pdf

25 For example, the Chinese government is becoming more serious about pollution issues, and is closing down the country's worst-polluting factories.

26 Sustainable Brands (2017) *Canopy releases viscose producer progress on deforestation-free supply chains*. 3 November. [ONLINE] Available at: http://www.sustainablebrands.com/news_and_views/supply_chain/sustainable_brands/canopy_releases_viscose_producer_progress_deforestati.

27 The Canopy Style Initiative (2016) *The Hot Button Issue*. [ONLINE] Available at: <http://canopyplanet.org/wp-content/uploads/2016/10/The-Hot-Button-Issue-The-CanopyStyle-Report-2016.pdf>

28 Aditya Birla Capital (2017) *Aditya Birla Capital: A leading financial services conglomerate*. Presentation, July 2017. [ONLINE] Available at: https://www.adityabirlacapital.com/-/media/abc/attachment/announcements-and-updates/aditya_birla_capital_investor_presentation_fy17.pdf; *The Hindu Business Line* (2017) Birlas enter top league with \$50-bn market cap; Tatas still on top. 3 September. [ONLINE] Available at: <http://www.thehindubusinessline.com/markets/market-valuation-of-top-companies/article9842279.ece>.

29 Aditya Birla Group (2018) *Companies*. [ONLINE] Available at: <http://www.adityabirla.com/Businesses/companies>.

30 Aditya Birla Capital (2017) *Aditya Birla Capital: A leading financial services conglomerate*. Presentation, July 2017. [ONLINE] Available at: https://www.adityabirlacapital.com/-/media/abc/attachment/announcements-and-updates/aditya_birla_capital_investor_presentation_fy17.pdf, p.4.

31 Aditya Birla Group (2018) *Fibre research*. [ONLINE] Available at: <http://www.adityabirla.com/innovation/fibre-research>

32 Birla Cellulose (2017) *Our fibres*. [ONLINE] Available at: <http://www.birlacellulose.com/textile-fibres-our-fibres.php>.

33 Birla Cellulose (2018) Message from the top management: Green and global. *Fibre2Fashion*. [ONLINE] Available at: <http://www.fibre2fashion.com/services/promotion/enhanced-sustainability/birlacellulose.asp>.

34 Canopy (2017) *The hot button issue: Detailed matrix of viscose producer performance: 2017 update*. [ONLINE] Available at: <http://canopyplanet.org/wp-content/uploads/2017/11/Canopy-Hot-Button-Matrix-EN.pdf>.

35 Grasim Industries Ltd. (2017) *Grasim Industries Ltd.* [ONLINE] Available at: http://www.grasim.net/about_us/index.htm.

36 Grasim Industries Ltd. (2017) *Unaudited consolidated financial results for the quarter and six months ended 30-09-2017*. [ONLINE] Available at: <http://www.grasim.com/pdf/Q2FY18-results.pdf>.

37 Grasim Industries Ltd. (2018) *Viscose staple fibre*. [ONLINE] Available at: <http://www.grasim.com/viscose.aspx>.

38 Birla Cellulose (n.d.) *Global flow: Pulp to fibre*. [ONLINE] Available at: http://www.birlacellulose.com/pdfs/Global_Flow_Pulp_to_Fibre.pdf.

39 Aditya Birla Group (2017) *Grasim Industries annual report 2016-17*. [ONLINE] Available at: http://www.grasim.net/investors/downloads/Grasim_Industries_annual_report_2016-17.pdf.

40 Udyawar, G. (2018) Grasim receives approval for expansion of Vilayat plant. *Dalal Street Investment Journal*, 22 January. [ONLINE] Available at: <http://www.dsij.in/DSIJArticleDetail/ArtMID/10163/ArticleID/339/Grasim-receives-approval-for-expansion-of-Vilayat-plant>.

41 Textile Excellence (2017) *Birla Cellulose to take its Liva brand viscose fabric to Bangladesh, Indonesia, China*. 6 May. [ONLINE] Available at: <http://www.textileexcellence.com/news/details/2103/birla-cellulose-to-take-its-liva-brand-viscose-fabric-to-banglade>.

42 Shrivastava, B. (2017) Aditya Birla Nuvo shareholders sign off on Grasim merger plan. *Bloomberg Markets*, 11 April. [ONLINE] Available at: <https://www.bloomberg.com/news/articles/2017-04-10/aditya-birla-nuvo-shareholders-sign-off-on-grasim-merger-plan>; and Khilnani, J. (2017) Five things you need to know about Aditya Birla Nuvo–Grasim merger. *Bloomberg Quint*, 13 April. [ONLINE] Available at: <https://www.bloomberquint.com/markets/2017/04/13/five-things-you-need-to-know-about-aditya-birla-nuvo-grasim-merger>.

43 Nace, T. (2017) China shuts down tens of thousands of factories in widespread pollution crackdown. *Forbes*, 24 October. [ONLINE] Available at: <https://www.forbes.com/sites/trevornace/2017/10/24/china-shuts-down-tens-of-thousands-of-factories-in-widespread-pollution-crackdown/#554c19fd4666>.

44 Institute of Power Engineers (IPE) (2017). *Green supply chain map*. [ONLINE] Available at: <http://www.ipe.org.cn/MapBrand/Brand.aspx?q=6>.

45 Udyawar, G. (2018) Grasim receives approval for expansion of Vilayat plant. *Dalal Street Investment Journal*, 22 January. [ONLINE] Available at: <http://www.dsij.in/DSIJArticleDetail/ArtMID/10163/ArticleID/339/Grasim-receives-approval-for-expansion-of-Vilayat-plant>; *The Hindu Business Line* (2018) Grasim gets eco clearance for Rs 2,560 cr expansion project. 21 January. [ONLINE] Available at: <http://www.thehindubusinessline.com/companies/grasim-gets-eco-clearance-for-rs-2560-cr-expansion-project/article10044976.ece>.

46 *The Hindu Business Line*, *ibid*.

47 Aditya Birla Group (2018) *PT Indo Bharat Rayon*. [ONLINE] Available at: [http://www.adityabirla.com/businesses/Profile/Pt-Indo-Bharat-Rayon-\(Indonesia\)](http://www.adityabirla.com/businesses/Profile/Pt-Indo-Bharat-Rayon-(Indonesia)).

48 *The President Post* (2015) Industry minister inaugurates world's second largest textile factory expansion. 12 October. [ONLINE] Available at: <http://www.thepresidentpost.com/2015/10/12/industry-minister-inaugurates-worlds-second-largest-textile-factory-expansion/>.

49 *YarnsAndFibers.com* (2017) Aditya Birla Group to invests [sic.] \$60m to expand its rayon plant in West Java. [ONLINE] Available at: <http://www.yarnsandfibers.com/news/news-tags/downstream-industries-textiles-and-textile-products>.

50 <http://www.adityabirla.com/media/features/an-all-encompassing-endeavour>

51 Birla Cellulose, 2017, <http://www.birlacellulose.com/non-woven-fibres-our-fibres.php>

52 Canopy Planet, The Hot Button Issue, 2017 update, <http://canopyplanet.org/wp-content/uploads/2017/11/Canopy-Hot-Button-Matrix-EN.pdf>

53 http://www.domsjo.adityabirla.com/en/Documents/sustainability_report.pdf

54 SFI Progress Report, 2017, <http://www.sfi-program.org/files/pdf/2017-sfi-progress-report/>

55 <https://cdn-s3.sappi.com/s3fs-public/slices/downloads/2015-Sappi-response-to-CDP-information-request-on-Forests.pdf>

56 <https://sustainability.adityabirla.com/pdf/reportspdf/Pulp%20and%20Fibre/2016.pdf> ; http://www.grasim.net/investors/downloads/Grasim_Industries_annual_report_2016-17.pdf

57 <https://www.sciencedirect.com/science/article/pii/S2444883416300286>

58 [http://www.adityabirla.com/businesses/Profile/Pt-Indo-Bharat-Rayon-\(Indonesia\)](http://www.adityabirla.com/businesses/Profile/Pt-Indo-Bharat-Rayon-(Indonesia))

59 <http://www.adityabirla.com/csr/overview>

60 Dirty Fashion:

61 Aditya Birla (2016) Domsjö Fabriker. [ONLINE] Available at: <http://www.domsjo.adityabirla.com/en/sidor/Domsjo-Fabriker.aspx>.

62 *Ibid*.

63 *The Economic Times* (2017) Sweden may rope in Birlas for joint project on smart textiles. 15 November. [ONLINE] Available at: <https://economictimes.indiatimes.com/industry/cons-products/garments/-/textiles/sweden-may-rope-in-birlas-for-joint-project-on-smart-textiles/articleshow/61662196.cms>; *The Hindu Business Line* (2017) Sweden eyeing possibility of developing smart textile with Aditya Birla Group. 15 November. [ONLINE] Available at: <http://www.thehindubusinessline.com/companies/sweden-eyeing-possibility-of-developing-smart-textile-with-aditya-birla-group/article9962598.ece>.

64 Gröna Trådar [Green Threads] (2018) *Svensk skog förgiftar floder i Indien* [Swedish forest poisons rivers in India]. 26 January. [ONLINE] Available at: <https://gronatradar.wordpress.com/tag/rad-och-ron/>.

65 Changing Markets (2017) *Dirty Fashion. How pollution in the global textiles supply chain is making viscose toxic*. [ONLINE] Available at: <https://changingmarkets.org/portfolio/dirty-fashion/>.

66 *Business Today* (2009) Lanxess AG acquires Gwalior Chemical Industries. [ONLINE] Available at: <https://www.businesstoday.in/magazine/deal-watch/lanxess-ag-acquires-gwalior-chemical-industries/story/4335.html>.

67 World Health Organization (WHO) (2000) Chapter 5.4: Carbon disulfide. *Air Quality Guidelines: 2nd edition*. Copenhagen: WHO Regional Office for Europe. [ONLINE] Available at: http://www.euro.who.int/_data/assets/pdf_file/0019/123058/AQG2ndEd_5_4carbdisulfide.PDF.

68 ECHA (n.d.) *Substance information: Carbon disulphide*. [ONLINE] Available at: <https://echa.europa.eu/substance-information/-/substanceinfo/100.000.767>.

69 Aditya Birla Group (2017) *Grasim Industries annual report 2016-17*. [ONLINE] Available at: http://www.grasim.net/investors/downloads/Grasim_Industries_annual_report_2016-17.pdf.

70 LANXESS (2018) *Manufacturing sites India: Nagda*. [ONLINE] Available at: <http://lanxess.in/manufacturing-sites-india/nagda-site-india/products-nagda-india/>.

71 Clariant (2018). *Welcome to Clariant in India*. [ONLINE] Available at: <https://www.clariant.com/en/Company/Contacts-and-Locations/Locations/Key-Sites/India>.

72 Central Pollution Control Board (CPCB) (2017) *Directions under Section 5 of the Environment (Protection) Act, 1986-reg*. Letter to Grasim Industries Ltd., 15 September. [ONLINE] Available at: <http://cpcb.nic.in/openpdf.php?id=UHVibGjYXRpb25GaWxlLzYyN-18xNTA2NjAwMzYxX2lZGhlcGhvdG8xNDg0OSwZGY=>

73 Northeast Georgia Regional Development Centre (n.d) Appendix B: Description of commonly considered water quality constituents. *Watershed Protection Plan Development Guidebook*. [ONLINE] Available at: https://epd.georgia.gov/sites/epd.georgia.gov/files/related_files/site_page/devwrtrplan_b.pdf.

74 Central Pollution Control Board (CPCB) (2017) *Directions under Section 5 of the Environment (Protection) Act, 1986-reg*. Letter to Grasim Industries Ltd., 31 October. [ONLINE] Available at: <http://cpcb.nic.in/openpdf.php?id=UHVibGjYXRpb25GaWxlLzYyN-2M18xNTEwODI2MzQyX2lZGhlcGhvdG8xNzMsMSwZGY>

75 Malviya, C. (2016) *Under Rule 377 in the Lok Sabha, Nagda sought to give strict punishment to Akhtar over the death of the Hui Labour brother in the Grasim industry @Grasim #nstormar* [Twitter]. 30 November. [ONLINE] Available at: <https://twitter.com/drchintamani/status/803958612527902720>.

76 Canadian Council of Ministers of the Environment (1999) *Canadian sediment quality guidelines for the protection of aquatic life: Zinc*. [ONLINE] Available at: <http://ceaq-rcqe.ccmce.ca/download/en/247>.

77 Dubey, D. (2017) *Grasim industry pollution nagda* [YouTube]. 22 May. [ONLINE] Available at: <https://www.youtube.com/watch?v=S3HB28XUy18>; <http://www.swarajdigital.in>.

78 Bhaskar News Network (2017) Disturbed by two deaths in three days in Parmarkari, industry group will prove villagers tankers to drinking water. *DainikBhaskar.com*, 30 October. [ONLINE] Available at: <https://www.bhaskar.com/news/MP-OTH-MAT-latest-nagda-news-061003-367821-NOR.html>.

79 *Ibid*.

80 *Ibid*.

81 Dubey, D. (2017) *Grasim industry pollution nagda* [YouTube]. 22 May. [ONLINE] Available at: <https://www.youtube.com/watch?v=S3HB28XUy18>.

82 WebMD (2018) *Fluorosis overview*. [ONLINE] Available at: <https://www.webmd.com/children/fluorosis-symptoms-causes-treatments#1>.

83 National Health Portal (NHP) India (2016) *Fluorosis*. [ONLINE] Available at: <https://www.nhp.gov.in/disease/non-communicable-disease/fluorosis>.

84 Central Pollution Control Board (CPCB) India (2007) *Status of groundwater quality in India: Part 1*, p.132. [ONLINE] Available at:

- <http://cpcb.nic.in/openpdffile.php?id=UmVwb3JORmlsZXMvTmV3SXRlbV80N19mb3Jld29yZC5wZGY=>.
- 85 Government of India Ministry of Water Resources Central Ground Water Board (2013) *District ground water information booklet: Ujjain District, Madhya Pradesh*. [ONLINE] Available at: http://www.cgwb.gov.in/District_Profile/MP/Ujjain.pdf.
- 86 India Water Portal (2010) *Water quality standards: Indian Standard for Drinking Water, Specification IS 10500: 1991*. [ONLINE] Available at: http://www.indiawaterportal.org/sites/indiawaterportal.org/files/indian_standard_for_drinking_water_as_per_bis_specifications_2010.pdf.
- 87 Reuters (2016) *India raises 2017 local wheat purchase price: Govt official*. 15 November. [ONLINE] Available at: <https://in.reuters.com/article/india-wheat-purchase-price/india-raises-2017-local-wheat-purchase-price-govt-official-idINKBN13A1VV>.
- 88 Aditya Birla Group (2017) *Grasim Industries annual report 2016-17*. [ONLINE] Available at: http://www.grasim.net/investors/downloads/Grasim_Industries_annual_report_2016-17.pdf.
- 89 Ibid.
- 90 World Health Organization (WHO) (2000) Chapter 5.4: Carbon disulfide. *Air Quality Guidelines: 2nd edition*. Copenhagen: WHO Regional Office for Europe. [ONLINE] Available at: http://www.euro.who.int/_data/assets/pdf_file/0019/123058/AQG2ndEd_5_4carbdisulfide.PDF.
- 91 US Environmental Protection Agency (EPA) (1992/2000) *Carbon disulfide*. [ONLINE] Available at: <https://www.epa.gov/sites/production/files/2016-09/documents/carbon-disulfide.pdf>.
- 92 Centers for Disease and Control and Prevention (2014) *International Chemical Safety Card: Carbon disulfide*. [ONLINE] Available at: <https://www.cdc.gov/niosh/ipcsneng/neng0022.html>.
- 93 EPA (2017) *Initial list of hazardous air pollutants with modifications*. [ONLINE] Available at: <https://www.epa.gov/haps/initial-list-hazardous-air-pollutants-modifications>.
- 94 Lay, M.D.S., Sauerhoff, M.W. and Saunders, D.R. (2000) Carbon disulfide. In *Ullmann's Encyclopedia of Industrial Chemistry*. Weinheim: Wiley-VCH. doi: 10.1002/14356007.a05.185.
- 95 WHO (2000) Chapter 5.4: Carbon disulfide. *Air Quality Guidelines: 2nd edition*. Copenhagen: WHO Regional Office for Europe. [ONLINE] Available at: http://www.euro.who.int/_data/assets/pdf_file/0019/123058/AQG2ndEd_5_4carbdisulfide.PDF.
- 96 Ibid.
- 97 MaterialWise (2018) *Carbon disulphide*. [ONLINE] Available at: <https://www.materialwise.org/>.
- 98 US Environmental Protection Agency (1992/2000) *Carbon disulfide*. [ONLINE] Available at: <https://www.epa.gov/sites/production/files/2016-09/documents/carbon-disulfide.pdf>.
- 99 WHO (2000) Chapter 5.4: Carbon disulfide. *Air Quality Guidelines: 2nd edition*. Copenhagen: WHO Regional Office for Europe. [ONLINE] Available at: http://www.euro.who.int/_data/assets/pdf_file/0019/123058/AQG2ndEd_5_4carbdisulfide.PDF.
- 100 FP News Service (2016) Ujjain: Malviya seeks central probe committee. *The Free Press Journal*, 1 December. [ONLINE] Available at: <http://www.freepressjournal.in/ujjain/ujjain-malviya-seeks-central-probe-committee/980074>; Mekaad, S. (2016) Fire at Grasim factory in Nagda, one killed. *The Times of India*, 17 November. [ONLINE] Available at: <https://timesofindia.indiatimes.com/city/indore/Fire-at-Grasim-factory-in-Nagda-one-killed/articleshow/55482498.cms>.
- 101 Greenpeace (n.d.) *Tanah air kita*. [ONLINE] Available at: <http://www.greenpeace.org/international/en/campaigns/detox/water/polluting-paradise/>.
- 102 Republic of Indonesia (2001) *Government Regulation No. 82/2001 regarding the Management of Water Quality and Water Pollution Control*, p.22A. [ONLINE] Available at: <http://extwprlegs1.fao.org/docs/pdf/ins69745.pdf>.
- 103 WHO (2017) *Guidelines for drinking-water quality, 4th edition incorporating the first addendum*. [ONLINE] Available at: <http://apps.who.int/iris/bitstream/10665/254637/1/9789241549950-eng.pdf?ua=1>.
- 104 Bata, A. and Nathalia, T. (2018) Businessmen donate billions of rupiah to clean up Citarum River. *Jakarta Globe*, 14 January. [ONLINE] Available at: <http://jakartaglobe.id/news/businessmen-donate-billions-rupiah-clean-citarum-river/>.
- 105 World Integrated Trade Solution (WITS) (2016) *Indonesia textiles and clothing export by country and region 2016*. [ONLINE] Available at: https://wits.worldbank.org/CountryProfile/en/Country/IDN/Year/2016/TradeFlow/Export/Partner/all/Product/50-63_Text-Cloth.
- 106 Greenpeace (n.d.) *Tanah air kita*. [ONLINE] Available at: <http://www.greenpeace.org/international/en/campaigns/detox/water/polluting-paradise/>.
- 107 Ganesha, A. (2018) Gov't plans huge project to clean up 'world's dirtiest river'. *Jakarta Globe*, 12 January. [ONLINE] Available at: <http://jakartaglobe.id/business/govt-plans-huge-project-to-clean-up-worlds-dirtiest-river/>.
- 108 Blacksmith Institute (2013) *The World's Worst 2013: The Top Ten Toxic Threats*. [ONLINE] Available at: <http://www.worstpolluted.org/docs/TopTenThreats2013.pdf>.
- 109 Ganesha, A. (2018) Gov't plans huge project to clean up 'world's dirtiest river'. *Jakarta Globe*, 12 January. [ONLINE] Available at: <http://jakartaglobe.id/business/govt-plans-huge-project-to-clean-up-worlds-dirtiest-river/>.
- 110 Hewson, J. (2013) Pollution flows freely in Indonesia's rivers. *Al Jazeera*, 21 November. [ONLINE] Available at: <http://www.aljazeera.com/indepth/features/2013/11/pollution-flows-freely-indonesia-rivers-2013112013166643513.html>.
- 111 Birry, A.A. (2016) This court victory in Indonesia could send shock waves across the fashion world. *Greenpeace*, 1 June. [ONLINE] Available at: <http://www.greenpeace.org/international/en/news/Blogs/makingwaves/detox-textile-Indonesia-pollution-court-victory/blog/56615/>.
- 112 Melawan Limbah (2016) *Konsekuensi tersembunyi* [Hidden consequences]. [ONLINE] Available at: https://www.academia.edu/32075262/KONSEKUENSI_TERSEMBUNYI.
- 113 Sheany (2018) Gov't to revitalize W. Java's Citarum River after dangerous pathogen discovered. *Jakarta Globe*, 10 January. [ONLINE] Available at: <http://jakartaglobe.id/news/govt-revitalize-w-javas-citarum-river-dangerous-pathogen-discovered/>.

