



Cambridge International AS & A Level

GLOBAL PERSPECTIVES & RESEARCH

9239/12

Paper 1 Written Examination

May/June 2021

INSERT

1 hour 30 minutes

INFORMATION

- This insert contains all the resources referred to in the questions.
- You may annotate this insert and use the blank spaces for planning. **Do not write your answers** on the insert.



This document has **4** pages. Any blank pages are indicated.

The following documents consider issues related to sustainable futures. Read them **both** in order to answer **all** the questions on the paper.

Document 1: adapted from *Seaweed, Indonesia's answer to the global plastic crisis*, written by Bakti Berlyanto Sedayu in 2018. The article was published on 'eco-business.com', Asia Pacific's Sustainability news site. The author is a PhD candidate at Victoria University, Australia, researching in biodegradable plastic from seaweed. He has worked in research institutes for 13 years, linked to the Indonesian Ministry of Marine Affairs and Fisheries.

The impact of global plastic use has reached an alarming level. Based on the latest data from US university research and the Sea Education Association, 9 billion tonnes of plastics have been produced since the 1950s, creating 7 billion tonnes of waste.

Some of this waste is in the form of tiny particles of plastic known as microplastics, which end up in water systems including the ocean, and in people's stomachs via drinking water or eating seafood. A recent study in *Environmental Research Letters* shows that there are up to 51 trillion microplastic particles, which equals 236,000 tonnes of waste, globally. So, plastic waste not only damages the environment and threatens animal life, but also presents health risks to humans.

Bioplastics offer an alternative solution. Big brands such as Coca-Cola, Heinz, Unilever, Nestlé, Danone and Nike have already started using bioplastics for their packaging. Bioplastics are starting to be used for a range of products, including shopping bags, disposable housewares and electronics. Bioplastics are more environmentally friendly and sustainable, as they are made from corn, sugarcane, vegetable oil and starch or bacteria. However, they require a huge financial investment in land, fertilisers and chemicals. Also, using plants for plastic production rather than food production can lead to food shortages. This in turn can lead to food price increases and a food crisis.

Seaweed is the best candidate for bioplastics so far. It is cheap, it can grow without fertilisers and it does not take up huge land space as it grows offshore. Also, the production of agricultural crops for food would not be threatened, so no food price increases or food crisis.

Indonesia can play a key role as it is one of the world's largest seaweed producers, with a third of global seaweed production. The Australian Centre for Pacific Islands Research states Indonesia's seaweed exports were valued at around USD 200 million in 2014, with production increasing at about 30% per year. It is also the world's largest producer of red seaweed, whose carbohydrate element is the key ingredient for bioplastics. A recent report from the UN Food and Agriculture Organisation suggests that Indonesia is a highly suitable place for red seaweed farming due to its climate, nutrients and geographical conditions.

Indonesia is also one step ahead of other countries in developing seaweed-based plastics. Indonesian start-up Evoware has invented cups and food containers made from farmed seaweeds and sold them commercially. This invention shows seaweed's huge potential as an alternative material for bioplastics. More research is needed to ensure that seaweed-based plastics can be applied to other plastic products. In the future, we hope that seaweed-based plastics will be as versatile as conventional plastics.

So, Indonesia should play a key role in developing eco-friendly plastics from seaweed to prevent an even worse global plastic crisis. When water bottles or shopping bags from seaweed-based plastics become waste, we will have nothing to worry about, as the waste will just go back to where it came from.

Document 2: adapted from *Turning waste into bioplastics, Mexico strikes green gold*, written by Sophie Hares in 2018 for the Thomas Reuters Foundation, the charitable arm of Reuters that covers issues including humanitarian news and climate change. The author is a freelance journalist and editor based in Mexico and has 20 years' experience at international news agencies including Reuters.

Industry experts say bioplastics – which are made with renewable, organic materials – have twin benefits. They are making use of waste to create products. These in turn are potentially quicker and easier to dispose of than traditional fossil fuel-based plastics.

But bioplastics are only 5% of the millions of tonnes of plastic produced globally each year and they have their own set of problems. Ford Motor Company is testing bio-based plastics to make its cars lighter and improve fuel economy. However, according to Deborah Mielewski, a senior technical leader for materials sustainability with Ford, resistance to change is the biggest barrier to bioplastics. She says “Everybody wants to have a cleaner planet and everybody wants to have cleaner air [and] reduce the amount of plastic in the ocean. But getting people to change what they’re doing today is really hard.”

Some scientists are looking to convert bacteria from sewage into the key chemicals to create biodegradable plastics. Kartik Chandran, Professor of environmental engineering at Columbia University (USA), said the potential for using organisms from organic waste was “close to infinite”. He added that this reduces costs of waste treatment and sanitation. However, consumers may not find the idea of this technology acceptable.

Scientists and industry insiders also warn that not all bioplastics are as environmentally friendly as they sound. Some contain high levels of traditional plastic, and depending on their uses and components, may not be biodegradable or compostable. Carlos Camacho Vivar, founder of Mexico’s Ecoshell company, adds that authorities need to understand the difference between various types of bioplastics. They can be biodegradable and compostable. But some are “bio-based” (part-organic, part-plastic), which actually makes disposal a challenge.

Ecoshell produces cutlery, bags and containers from sugar cane and corn starch from industrial waste. Vivar says these products will break down in months rather than the hundreds of years needed for traditional plastic. David Grewell, Director of the Iowa Center for Bioplastics and Biocomposites (USA), says bioplastics are attracting a high level of attention, but they cannot solve the problem of disposal. He adds, “We would not want to start recommending that it’s OK to throw bioplastics into the water.”

Scientists in Mexico are experimenting by converting materials from cactus, shrimp shells and human waste into alternative greener plastics. Based at the centre of Mexico’s avocado industry, BIOFASE uses tonnes of discarded avocado stones each day to produce its drinking straws and cutlery. Scott Munguia, founder of the company says, “The whole world is changing – people are starting to ask for this.” However, he adds the main obstacle is the cost of producing bioplastics. Ecoshell’s founder Camacho says that in Mexico, moves to outlaw the use of plastic bags and polystyrene could help boost demand for bioplastics. “But new technology is always expensive.”

It seems therefore that while the technology for bioplastics is progressing, major hurdles remain, including how to make bioplastics attractive to consumers, easier to dispose of and affordable.

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