

Life-cycle assessment

Education in Chemistry

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Use this worksheet to scaffold your students in evaluating a life cycle assessment for the three types of bags mentioned in the article.

Life cycle assessments commonly make up longer answer questions for 14–16 year olds, requiring them to evaluate the sustainability of products from their raw materials and processing through to disposal. The article alongside other research sources will help students make a full evaluation of the different bag materials mentioned and prompt debate about which kind of bag is 'best'.

Page 2: Teacher answers

Page 3: Blank table for student use

STAGE OF LIFE CYCLE	Key questions	Poly(ethene) bag	Cotton bag	Compostable bag
RAW MATERIALS	<i>Made from</i>	Poly(ethene) an addition polymer made from ethene	Cotton	Starch
	<i>Source of raw materials</i>	Crude oil	Cotton plant	Potato
	<i>Geographic location of raw material</i>	Middle East, Russia, USA	USA, India, China, Brazil, Pakistan	Worldwide
	<i>Pollution and associated energy use in raw materials (eg transport)</i>	Raw materials transported across the world in tankers	Raw materials transported across the world in tankers	Can be made from vegetables in most countries so low transport.
	<i>Sustainability of raw materials</i>	From fossil fuel – not sustainable	Sustainable	Sustainable
MANUFACTURING AND PROCESSING	<i>Processes needed to make raw material into the material used in the bag</i>	Fractional distillation of crude oil Polymerisation Shaping/colouring	Harvesting, separating cotton fibre from other plant material, carding and combing, spinning, weaving. Bleaching may also be carried out.	Harvesting, pulping, starch extraction, pH adjustment, shaping
	<i>Pollution and associated energy</i>	Lots of energy needed in both processes	Lots of energy needed in processes Bleaching may produce chemical waste	Low energy process
CONSUMER USE	<i>Likely useful lifetime of the product (years)</i>	1–5 years depending on thickness	10 years	6–12 months
	<i>How many times is the consumer likely to reuse?</i>	Potentially lots but consumer practice tends to mean they are reused much less	Hundreds	10–20
CONSUMER DISPOSAL	<i>Disposal at end of useful life Can it be recycled?</i>	Landfill, limited recycling	Landfill or charity shop/rag bin	Landfill or compost bin

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MANUFACTURING AND PROCESSING	<i>Processes needed to make raw material into the material used in the bag</i>			
	<i>Pollution and associated energy</i>			
CONSUMER USE	<i>Likely useful lifetime of the product (years)</i>			
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