

Business Skills and Commercial Awareness for Chemists

PET Replacement Scenario

Developed by the University of York and University of Warwick

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Polyethylene terephthalate (PET) replacement scenario

Background

Our company is a leading manufacturer of bottles for the packaging industry. The Company Directors have recently made an announcement that they want the company to improve its sustainability and reduce its carbon footprint. The target is a green replacement for polyethylene terephthalate (PET) for use in making bottles. Your brief is to investigate opportunities for your company to achieve this and present them to a group of senior managers within the company.

There are a number of replacements for PET currently in development or on the market, and you will have to evaluate each of these to a greater or lesser extent to make a recommendation to the board as to which opportunity should be taken. The five possibilities are:

- PLA (polylactic acid)
- PEF (polyethylene furandicarboxylate)
- Bioderived PET (either partially or fully)
- PE (polyethylene)
- Glass

To make an informed recommendation you will have to familiarise yourself with a number of different relevant areas for this such as:

- Drivers for the manufacture of greener consumer products
- The 12 principles of green chemistry
- Green chemical technologies
- General properties of PET, in particular the key performance indicators (KPIs)

Research on PET and its replacements

Search for information on the current commercial synthesis of PET, and determine as much as you can about reagents, process conditions, reaction type and mechanism of each step in the route. Following on from this evaluation you can make suggestions to make environmental improvements to the process and thus the business. Initially you will need to identify where the green issues lie with PET: identify general and specific environmental issues and 'hot spots' for PET by looking at all stages in the lifecycle: from raw materials through to production, use and end of life. In particular things to consider include:

- Are there particular chemicals typically used in the manufacture of PET that are under scrutiny in terms of their environmental profile?
- Are the raw materials used in the manufacture of PET sourced from renewable feedstocks?
- Are there issues surrounding security of future supply of materials?
- How efficient is the production process? Are there significant amounts of waste produced?
- What happens to the product at end of life?
- Are there any particular current concerns from consumer groups/retailers that are putting pressure on supply chains to make modifications/substitutions in the manufacturing process?

Market Research

Explore case studies where other companies have been successful in designing greener replacements for PET (a number of large organisations have made progress in the field of PET replacements including Coca Cola, Pepsi-co, Danone, Avantium and Braskem alongside others). What is the size of the market for this type of product? What is the potential for growth?

Replacement

Search for information on the manufacture of each of the suggested five replacements and determine as much as you can about reagents, reaction type, process conditions and mechanism of each step in the route. Again, look at all stages in the life cycle of the replacement product and consider raw material use through to end of life. Compare this with the information you found earlier on the manufacture of PET. What are the properties (KPIs) of the replacement material and how do they differ from those of PET?

Task

Your task is to advise the company management on the best way to green the company by replacement of PET. You should consider

- The cost of dropping in any replacement material on the existing manufacturing plant and processes. It may be that the cost of replacement plant is too high to justify a switch and so the recommendation may be to retain PET
- The IP landscape for each of the replacement materials, would Coca-Cola consider prosecuting for infringement of IP? If so, do you have the resources for the battle?
- Replacing any product on the open market for selling to the public has associated regulatory issues. Although these are reduced for polymeric materials, are the costs too high?
- Marketing: this is the potential 'big win'. If you can demonstrate that your new PET replacement bottle is greener than existing PET bottles can you offset the potential costs risks above; how much is the green badge worth?
- What is the mechanism for making this happen; does your company keep it in-house and produce the material; do you spin out a separate company that can sell the technology to competitors/in alternative markets?

Please present your recommendations in a report/business plan including a ca. 150 word executive summary.

Assessment

If your report is to be assessed as part of your coursework, please consult your tutors for the assessment criteria.