Dual barrier for moulded fibre bottles

The Danish Technological Institute (DTI) is continuing to explore new dual barrier options for moulded fibre bottles, first outlined to IAPRI members at the June Conference in Brazil.

The DTI has been working with small Danish business ecoXpac, which produces the bottles using a patented energy-saving vacuum-forming process. The bottles are biodegradable and potentially compostable. Currently, says DTI product manager Alexander Bardenshtein, pilot production has been limited to around 10 bottles an hour.

The DTI team has been active on the production side, suggesting a thermoformed plastic 'mesh' to replace the previous stainless steel mesh used in the forming process, which is laborious, time-consuming – and costly – to produce.

But most of the research effort has gone into trialling different material combinations to provide oxygen, water vapour and liquid barrier in complementary layers. "We have deposited biobased coatings, trying plasticised starch, synthetic polymers such as ethylene vinyl alcohol (EVOH) and gelatin-based coatings," says Bardenshtein. "We are going to try coatings based on whey proteins, too."

The ecoXpac bottle

Of course, individual coating formulations have to be fine-tuned, too. "For example, if we found a better plasticiser to combine with a starch coating, that could work well," he says.

"Finding a good intermediate coating with an adequate oxygen barrier should not be problematic," Bardenshtein explains. "But you also need a complementary layer to make it waterproof and provide a water vapour barrier. We are currently using silicon oxide (SiOx), but are also looking at aluminium oxide (AlOx) and diamond-like carbon. Any inorganic nanoscale coating would be a good candidate."

Where EVOH is used as the intermediate barrier, the addition of SiOx not only acts as a liquid barrier but also improves the oxygen barrier by a factor of three.

New biobased options are becoming available all the time, says the DTI, and it is interested in any viable suggestions for the intermediate layer. "But the processes have to be readily-combined and complementary," says Bardenshtein. "We have to be sure that the plasma enhanced chemical vapour deposition (PECVD) layer is being applied properly and consistently."

A synergistic combination of barriers of this sort would give drinking yoghurt in the exoXpac bottle a similar shelf-life to high

'The processes have to be readily-combined and complementary'

density polyethylene (HDPE), he says. Other liquids which could be packaged in the bottle include milk and still water.

On the outer surface of the bottle, the DTI has used chemical grafting to make the top layer of the cellulose water-resistant. "One of the main challenges in identifying these materials and processes has been maintaining the pack's biodegradability," says Bardenshtein.

www.dti.dk