

# Developing a pathway for increased recycled plastic in milk bottles

## CASE STUDY SUMMARY

### Project overview

The aim of this Dairy Australia Technology Assessment (DATA) project was to develop a pathway for Bega Dairy and Drinks (Bega) to increase the recycled-HDPE<sup>1</sup> (r-HDPE) content of their two-litre (2L) and three-litre (3L) milk bottles to 50 per cent (%) or greater. It did so by assessing the functional impact of using increased levels of food grade r-HDPE resin in 2L milk bottles which were then subjected a series of closed loop recycling studies.

By increasing the recycled resin content in its milk bottles, Bega's ultimate objective was to address a key element of the Australian government's National Packaging Targets 2025: *50% average recycled content will be included across all packaging by 2025.*

While up to 20% recycled resin has been previously used in milk bottles in Australia, it was uncertain if this percentage could be increased, especially using locally sourced recycled resin. This is largely because there is a lack of evidence both locally and globally as to the impacts of using r-HDPE addition rates higher than 40% in milk bottles – particularly with respect to the thermal degradation of r-HDPE resin during repeated re-processing in available recycling systems and the subsequent mechanical, chemical and sensory aspects of the finished bottle.

Therefore, the objectives of this study were:

- 1 To investigate the potential to increase the r-HDPE content in 2L and 3L milk bottles to approximately 50%.
- 2 To understand the structural, sensory and milk quality aspects associated with increasing the r-HDPE content and provide clear advice on where the limits are and why.
- 3 To understand if locally sourced r-HDPE will provide the same outcomes as imported European r-HDPE and to work with local industry to develop the knowledge required to produce higher quality r-HDPE locally.



Trials were conducted using virgin HDPE resin supplied by Qenos, local post-consumer recycled HDPE and a 2L bottle design supplied by Bega. Resin blending and bottle blowing was carried out by Qenos at its research facility.

Resin and finished bottle testing were conducted by both Qenos and Bega.

### Relevance of the study to the Australian dairy industry

*The Australian government's National Packaging Targets 2025 are:*

- 1 *100% of all Australia's packaging will be reusable, recyclable or compostable by 2025 or earlier.*
- 2 *70% of Australia's plastic packaging will be recycled or composted by 2025 and 50% average recycled content will be included across all packaging by 2025.*
- 3 *Problematic and unnecessary single-use plastic packaging will be phased out through design, innovation or introduction of alternatives.*

These targets are relevant for all manufacturers of packaging as well as users of packaging, including brand owners. HDPE bottles are the most common format of packaging used to package fresh milk, of which 2L bottles make up about 70% to 80% of all fresh milk packaging.

<sup>1</sup> HDPE = high density polyethylene, a plastic polymer used to make blow-moulded milk bottles

By undertaking work which enables the recycled content of milk bottles to be increased, the dairy industry stands a better chance of meeting the national packaging target of 50% recycled content. It also provides a clear message to consumers that we are serious about improving environmental impact of our operations and helps retain our social license to operate.

**The expectation is that this study will support Australian dairy industry to reach a point where our milk bottles enter a truly circular economy, and we can approach a state where approximately 50% of discarded bottles are re-used locally within new milk bottles following collection from local waste companies.**

### Key outcomes

The project was successful in determining the impact of multiple recycling loops for milk bottles with 50% r-HDPE content. In addition to assessing the thermal stability of the bottles produced, the technical properties of different polymer blends and bottles made with these blends were determined and then compared with those arising from bottles made from 100% virgin HDPE.

Results show that a blend rate of 50% r-HDPE with virgin HDPE in the first loop, and the blending of the recycled and re-pelletized material at the same addition rate for subsequent loops, produces a "looped" resin blend with comparable material properties during blow-molding (such as rheology, gelling and color) and comparable finished bottle properties (such as top load, drop tolerance, taint and aesthetics).

Bottle weight, wall thickness and brimful capacity were maintained at a consistent level throughout the trial to ensure good comparison in terms of performance with virgin bottles.

A drop in top load of 5% was noted in the 1st loop with 50% addition rate; this improved in subsequent loops. However, further evaluation with other r-HDPE batches is required to understand if this reduction is inherent to the material and blends.

Drop tolerance of 0.5m was successfully demonstrated for bottles from all loops, meeting the requirements for the 2L bottle design (proprietary to Bega) and confirming that addition of r-HDPE did not impact the performance of the bottle.

Addition of r-HDPE does slightly impact the color of the milk bottles. However, this is apparent in empty bottles in a side-by-side comparison only. In filled bottles (with white milk), the 50% r-HDPE blend bottles appear "whiter" due to the contrast and opacity.

A stronger odor is noted in the bottles from the 1st loop; this odor dissipates in the subsequent loops. Taint transfer testings and white milk sensory testing with full fat white milk confirmed that there is no discernible influence of the recycled resin on the organoleptic properties of food stored in the bottles for the duration of its shelf life.

There is no chemical or heavy metal migration or leaching from the 50% r-HDPE blend bottles into white milk.

### Next steps

Bega has created a sustainability roadmap in order to meet the 50% recycle content target by 2025.

This feasibility study supports that roadmap, in that it provides the necessary evidence base to help Bega move forward with greater confidence towards an ambition of gradually increasing the r-HDPE content in its milk bottles to 50% by 2025, with a planned start in 2022.

The availability of the food grade r-HDPE in the market will be a determining factor as to whether Bega, and the dairy industry more broadly, are able to achieve their recycled content goals.

#### FOR FURTHER INFORMATION

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