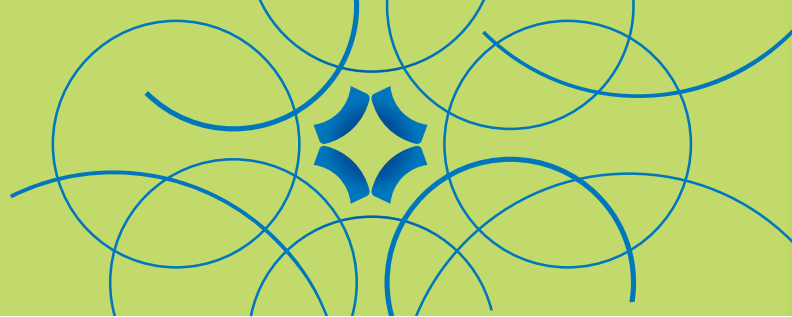


STREAMLINED LIFE CYCLE ASSESSMENT*

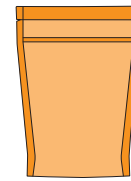


STAND-UP POUCH COMPARISON

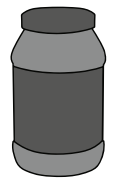
Protein powders are often sold in a rigid package, but can also be found sold in flexible packaging formats such as Stand-up Pouches (SUP). For this comparison, 2 separate SUPs were evaluated with the rigid HDPE canister as the standard to which other packages are compared. A product weight of 584g was used for the comparison.



PCR SUP



TRADITIONAL
SUP

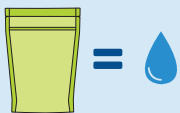


HDPE
CANISTER



Water Consumption

The stand-up pouches result in substantial reduction in water use (**-72.57%**) vs. the rigid canister. Since less material is being used, it would make sense that water use would also be reduced. The PCR pouch results in the least amount of water used due to the use of cleaning PCR flakes, which is less intensive than using water in the initial material production phase.



Greenhouse Gas Emissions

All stand-up pouches resulted in far less GHG emissions than the canister across the material manufacture, conversion (manufacturing) and end of life phases. Again, the use of PCR results in an additional emission savings (**-85.16%**) vs. the traditional pouch. This is generally the case when PCR utilized in any application.



0.0635
KG-CO2 EQUIV



0.0761
KG-CO2 EQUIV



0.428
KG-CO2 EQUIV



Fossil Fuel Consumption

The SUP options result in a significant reduction in fossil fuel use compared to the current canister. This is largely driven by the canister weighing 4-5 times (108.3g vs. 20.73g/ 24.92g) that of the pouches. The PCR structure (**-72.57%**) has a further reduction over the traditional SUP since it utilizes a large overall percentage of PCR material (53%).



1.40
MJ-EQUIV



1.89
MJ-EQUIV



10.83
MJ-EQUIV

END OF USE SUMMARY

SOURCE REDUCTION BENEFITS

According to the U.S. EPA Waste Hierarchy, the most preferred method for waste management is source reduction and reuse.

A major benefit of flexible packaging is the high product-to-package ratio that it offers.

RECOVERY BENEFITS

POST-CONSUMER
RECYCLED (PCR)
STAND-UP POUCH



1x

amount of material ending up
as municipal solid waste

TRADITIONAL
STAND-UP
POUCH



1x

amount of material ending up
as municipal solid waste

HDPE
CANISTER



4.6x

amount of material ending up
as municipal solid waste

High product-to-package ratio:



96.6%

Product weight

3.4%

Package weight

Low product-to-package ratio:



84.4%

Product weight









15.6%

Package weight

The rigid HDPE canister results in substantially more material being discarded at the end of life (162,442g vs. 35,219g-42,394g of packaging for 1000 kg of product) when taking into consideration estimated current recycling rates for HDPE canisters (18%).

IMPLICATIONS

The results show that the stand-up pouch (SUP) variations all have lower environmental impacts including fossil fuel usage, GHG emissions, and water usage in this scenario than the rigid HDPE container. The table below shows the results when current recycling rates are considered, as well the product-to-package ratio, which is a measure of the resource efficiency of the materials used.

FORMAT	 FOSSIL FUEL CONSUMPTION (MJ-EQUIV)	 GHG EMISSIONS (KG-CO ₂ EQUIV)	 WATER CONSUMPTION (L)	 PRODUCT-TO-PACKAGE RATIO (%)	 PKG LANDFILLED (G)/1,000 KG SYRUP
PCR SUP 	1.40 (-87.07%)	0.0635 (-85.16%)	41.75 (-72.57%)	96.6% : 3.4%	35,390 (-78.2%)
TRADITIONAL SUP 	1.89 (-82.55%)	0.0761 (-82.22%)	54.05 (-64.49%)	96.6% : 3.4%	35,219 (-78.3%)
HDPE CANISTER 	10.83	0.428	152.22	84.4% : 15.6%	162,442



For more information and methodologies of assessments, please visit www.flexpack.org or www.glenroy.com to download Glenroy's "A Streamlined Life Cycle Assessment Comparison for Glenroy® Stand-up Pouch Options vs. Rigid HDPE Canister" report.