CHEMISTRY THAT MATTERS™

ANANDA SEKAR, ASHOK MENON

Balances of biogenic carbon accounting within and across lives of polymer product systems: A case study approach towards standardization of LCA and GHG accounting frameworks

PROBLEM STATEMENT

In context of heightened focus towards carbon neutrality, bio-based chemicals and polymer products has potential to play a central role in decarbonization of petrochemical industry.

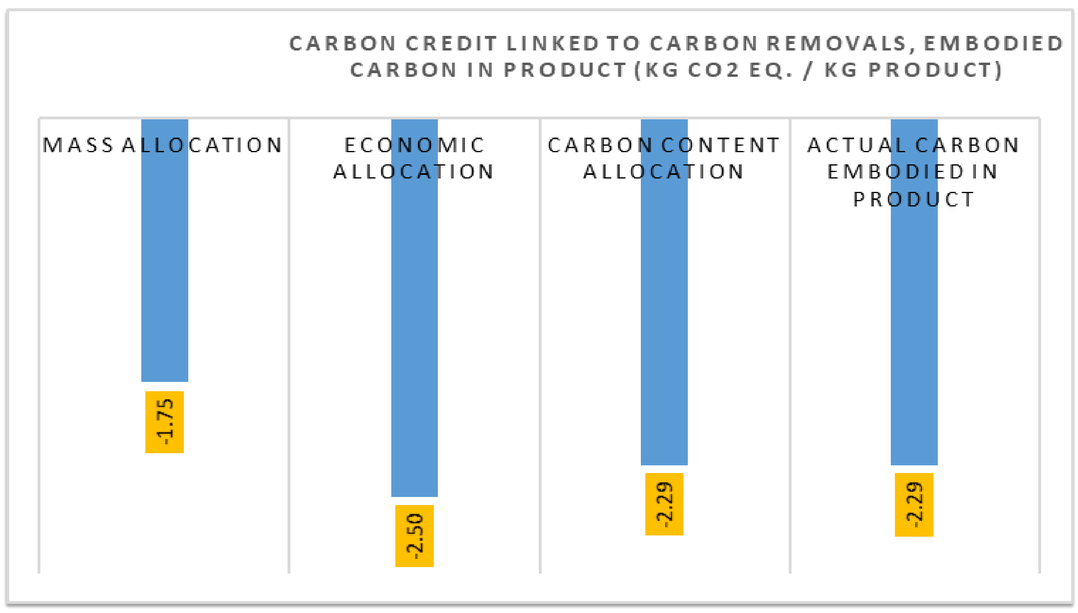
Standardization of biogenic carbon accounting in various methodological frameworks within and outside LCA framework becomes very crucial to ensure consistency in measurement and tracking.

Contrasting results may potentially arise due to allocation approaches and choice of methods. On a related note, handling of biogenic carbon in GHG protocol has contrasting approaches that leads to differences in product level accounting based on LCA and corporate level accounting of Scope 1,2,3.

STUDY APPROACH AND SYSTEM DEFNITION

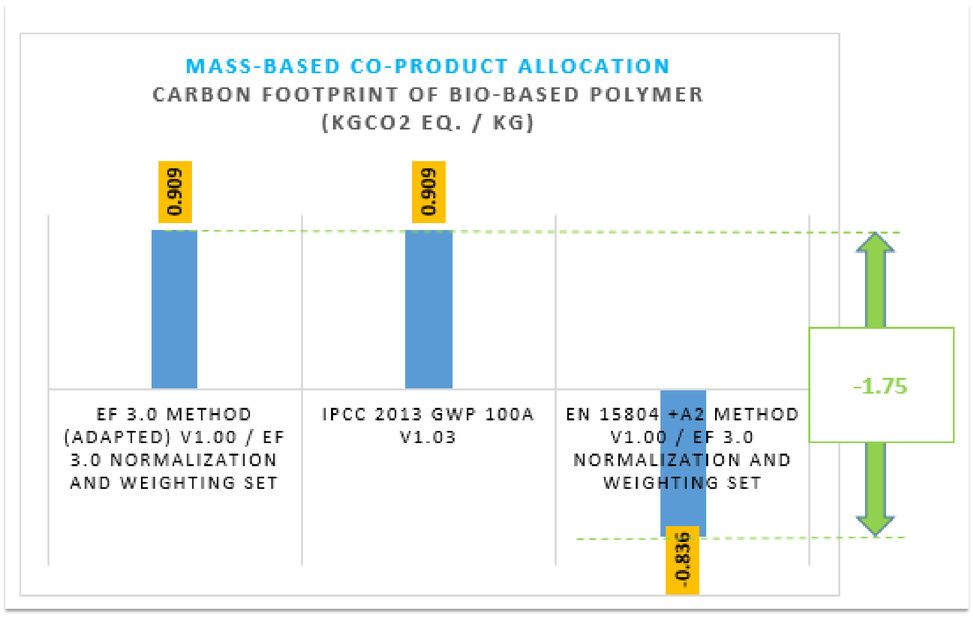
To demonstrate the above context in product LCA, a bio-based polymer production system with the below carbon flows description has been conceived.

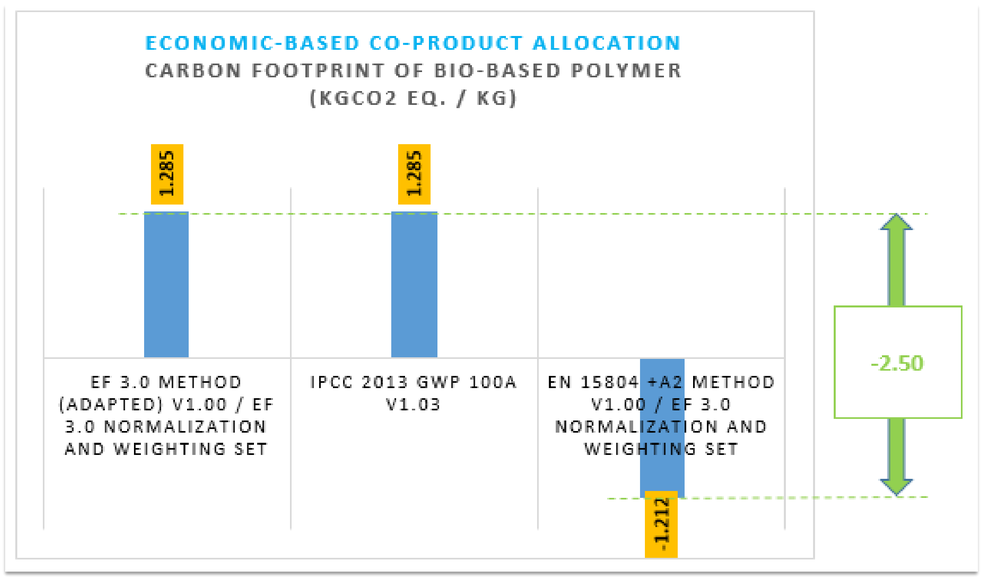
			Production / manufacturing				
			Biomass cultivation	Biomass conversion step 1	Biomass conversion to feedstock	Bio-based monomer production	Bio-based polymer production
	Unit	Sequestration or removal	Biomass	Intermediate 1	Intermediate 2	Main product | co-product	Final product
Mass of material	Kg	200	200	185	167	**88 | 79**	87
Mass of biogenic carbon	Kg-C	-100	100.00	90.00	80.00	**55 | 25**	54.45
Mass of biogenic carbon emitted as CO2 during processing (losses)	Kg-C	0	0	10	10	0.0	0.55
Mass of fossil carbon emitted as CO2 (fuel combustion, electricity generation, etc.)	Kg-C	0	10	10	10	10	10
Mass of biogenic CO2	kg-CO2	-366.7	0.0	36.7	36.7	0.0	2.0
Mass of fossil CO2	kg-CO2	0	36.7	36.7	36.7	36.7	36.7

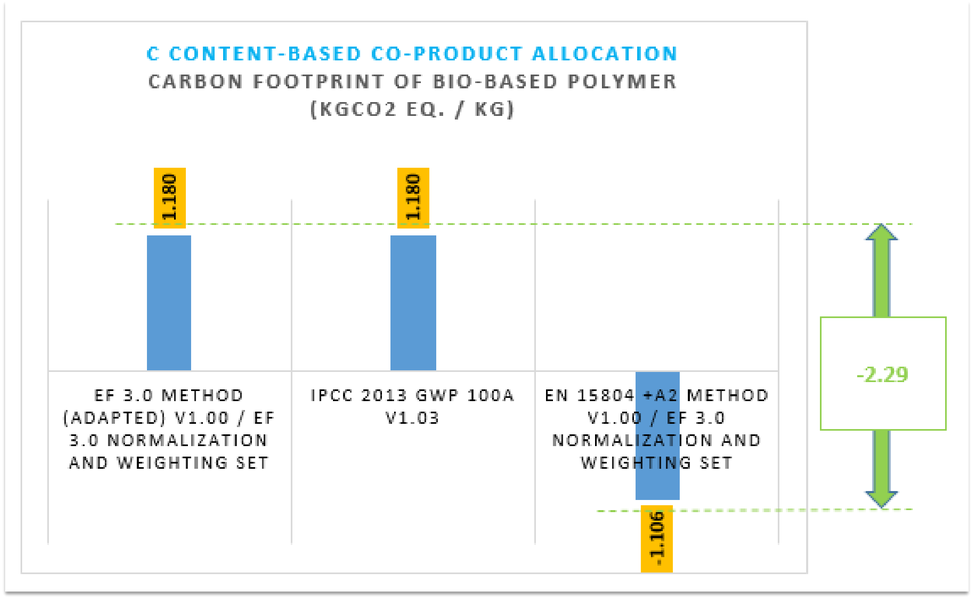


RESULTS AND DISCUSSIONS

The analytics indicate the potential for distortion of credits between by-products when using different allocation choices. The study recommends a carbon content based allocation approach for such studies on products that are developed with primary benefits linked to decarbonization.







FURTHER WORK

These distortions in biogenic credit passing over to products is accentuated when End-of-life considerations are taken into account. For instance, the benefits of biogenic carbon stored in products are required to be either passed over to second life of the recycled materials (PAS 2050) or remain unrealized (GHG Protocol).

An approach that considers an effective allocation approach across multi-lives of polymeric materials is also proposed.