



Up-cycling Process Feasibility for Coupled Radiolytic and Biochemical Conversion of Polyethylene Progress Check In

April 2021

Changing the World's Energy Future

Gregory P Horne



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Idaho Falls, Idaho 83415**

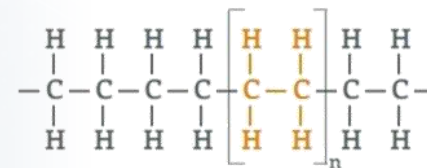
<http://www.inl.gov>

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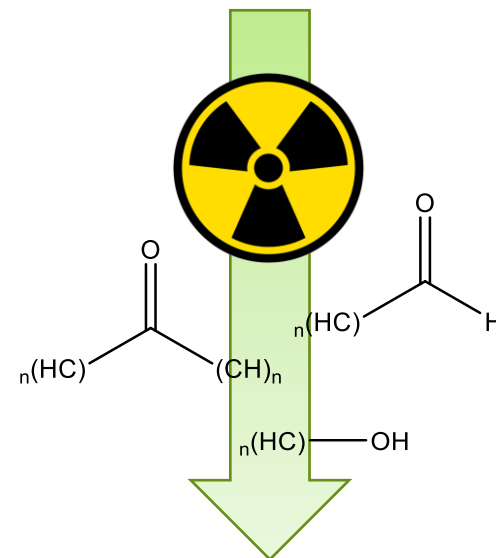
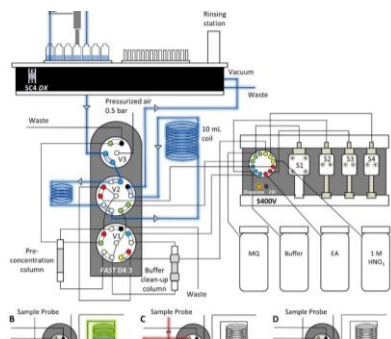
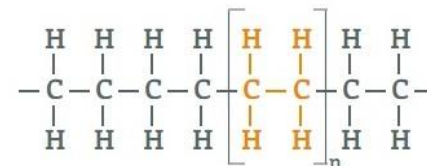
Center for Radiation
Chemistry Research



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Radiolytic and Biochemical Conversion



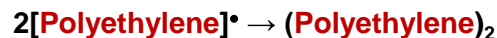
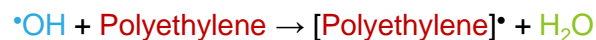
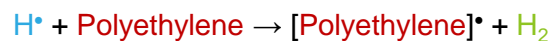
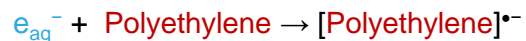
**Chemical
Feedstocks**

- Charelesby, A., Atomic Radiation and Polymers 1st Edition - International Series of Monographs on Radiations Effects in Materials, Vol. 1. Pergamon Press, **1960**.
- Charlesby, A., Radiation Mechanisms in Polymers. Advances in Chemistry - Irradiation of Polymers Vol. 66, American Chemical Society, Washington DC, **1967**.
- Sivan, A., Szanto, M., Pavlov, V., *Appl. Microbial Biotech.*, **2006**, 72, 346.
- Li, W., Chung, H., Daeflfer, C., Johnson, J.A., Grubbs, R.H., *Macromolecules*, **2012**, 45, 9595.

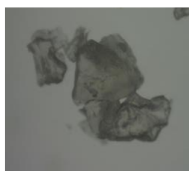
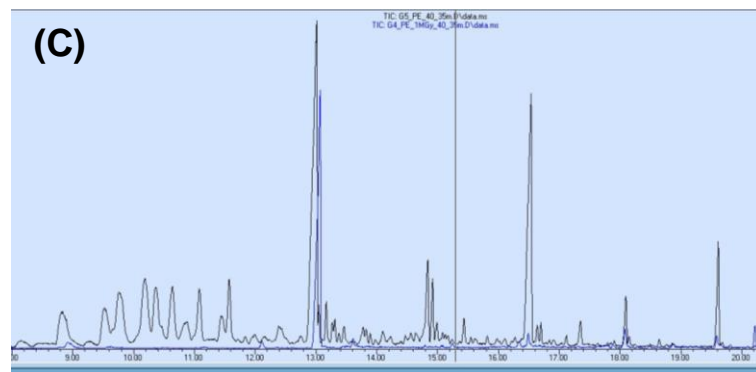
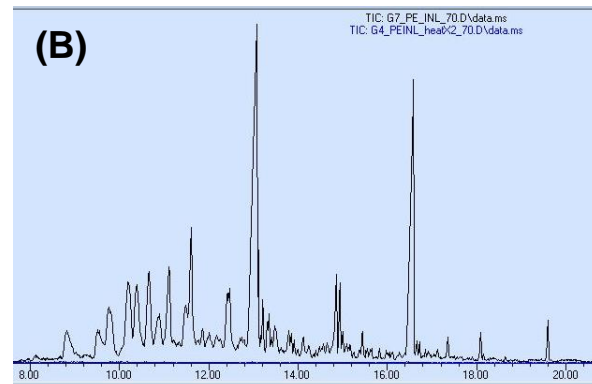
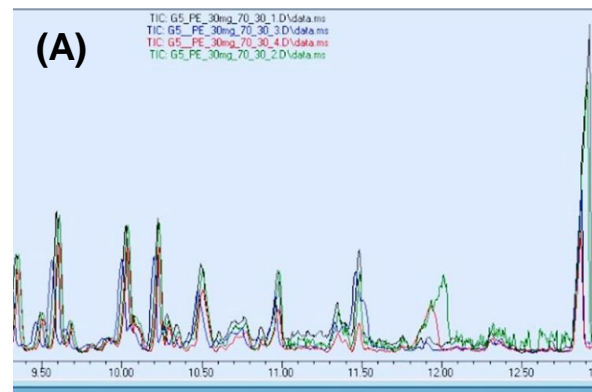
Research Progress

Irradiation Conditions

- **Polyethylene in water or salt water**
 - ~0.5, 1.0, and 2.0 MGy
 - Initial dissolved O₂ radiolytically consumed.
- **First set of data simulates anaerobic conditions**



- **Commercial material found to contain ~0.5% impurities**
 - Procedure developed for cleaning PE material: heated at 70°C for 50 hours.
- **SPME-GCMS analysis showed very low amounts of hydrocarbon products.**
- **Irradiated particles appeared to be larger/combined via microscopic analysis.**



water



