



Sustainable life-cycles

Time is the only thing we can't recycle.

The challenges of dealing with waste plastic in the Australia-Pacific region present us with significant opportunities.

Will they pass us by?.....

Dr Michael Batten



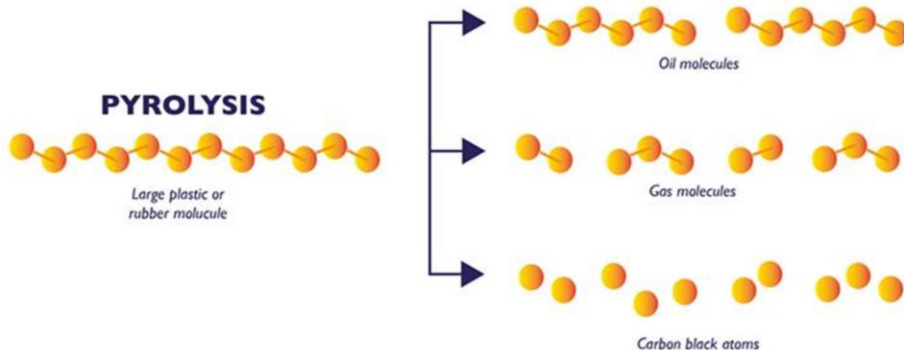


Sustainable life-cycles

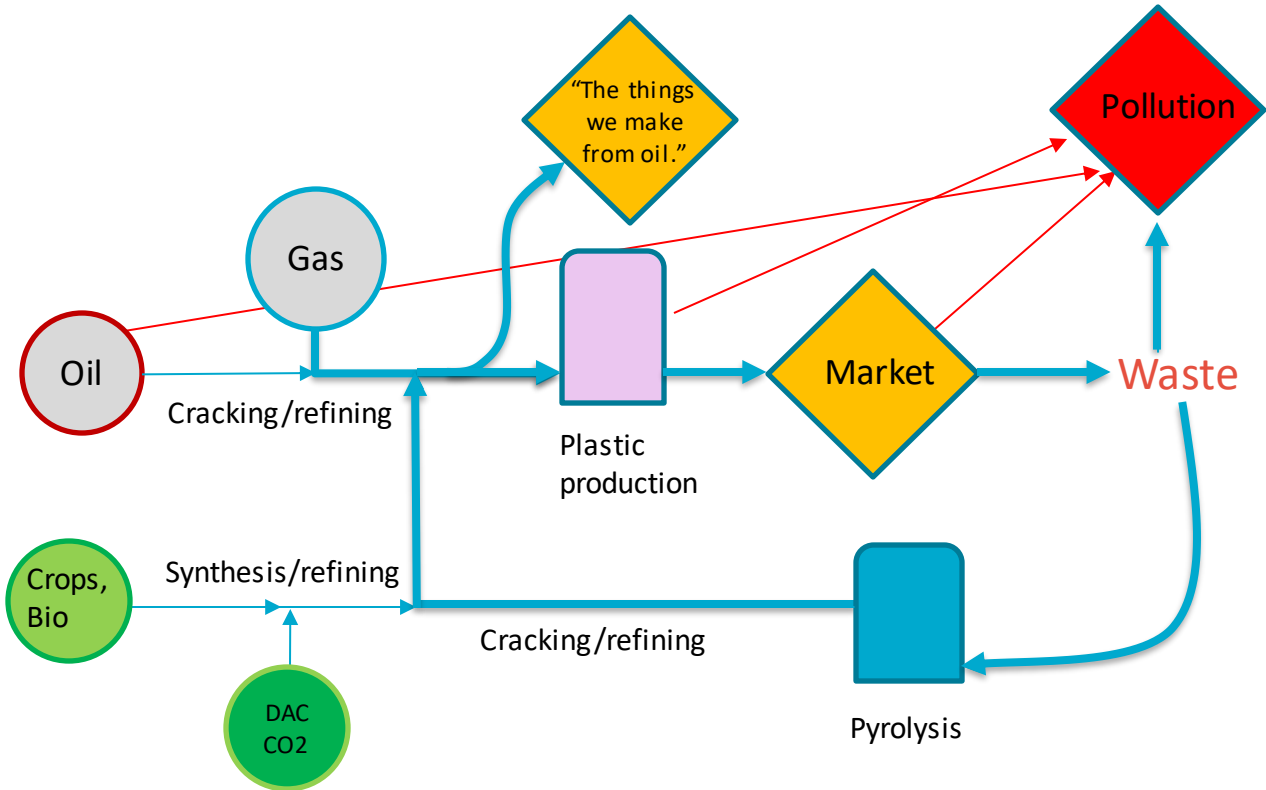
- Advanced Recycling and Plastic pyrolysis – technology
- Post-consumer plastic waste as a central material in our future economy
- Some new science and CSIRO research efforts focussing on the following challenges:
 - Optimising the social and economic fit of Advanced Recycling.
 - Developing high-value products from post-consumer plastic.
 - Boosting market efficiency of post consumer plastic commodities.

Advanced Recycling - Pyrolysis

- AR - Conversion of to monomer or production of new raw materials by changing the chemical structure. Excludes energy recovery and incineration.
- PET hydrolysis
- Polyolefin plastics (PP, PE, HDPE) – pyrolysis – ‘permanent melt’ back into crude oil.



AR/Pyrolysis in the circular economy





Critical Juncture

- 2 Paths away from landfilling of waste.
 - Advanced Recycling needs – capital investment, legal framework, acceptance.
 - Waste-to-energy (WTE) will be a low-cost competitor.
 - Can circular routes via high-value products compete with WTE?
- Some of the technical challenges CSIRO is working on.
 - Proving AR's worth, establishing its beneficial limits.
 - Developing high-value products from post-use plastic (Energy = low value).
 - Quickly establishing an open efficient market for post-use commodities.



CSIRO Research showcase - GTM

- Indonesian pilot for regional processing model.
- Appropriate, robust technology.
- Highest standards for quality and safety –design in.
- Leading edge product purification - CSIRO.



CURRENT PROJECT PARTNERS



Multinational collaboration to futureproof our process

Aligning with euro standards and UNDP sustainable development goals.



CSIRO Research showcase - GTM

CSIRO supporting through:

- Indo-Pacific Plastics Innovation Networks Grant (IPPIN).
- Process design expertise.



GTM's operations providing:

- Crystallization of local collection and re-use networks.
- Fuel safety evidence for pyrolysis oil (WHO).
- Recycling insecticide-treated mosquito-nets (WHO).





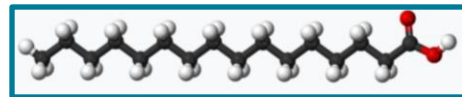
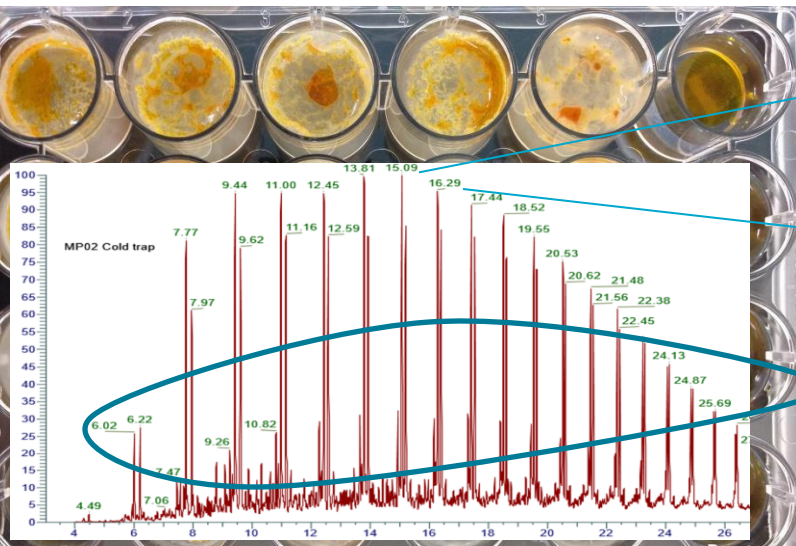
CSIRO Research showcase

– Microbial transformation of Pyrolysis oil

Bioprospecting project.

Uses microbes adapted to living in petroleum contaminated environments.

Applied to various grades of pyrolysis oil.



Replacements for industrial palm oil



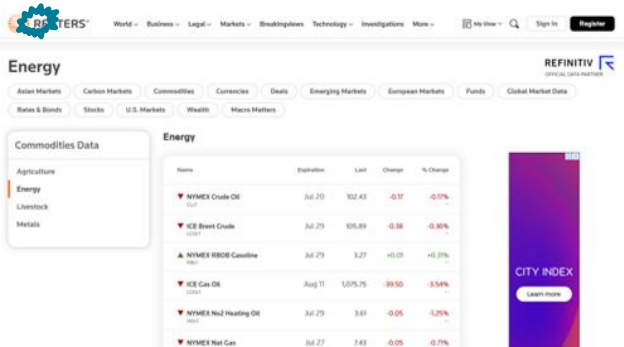
Soaps

Carbon source
for biofactory



CSIRO Research showcase – Matrix-CoinP

Laboratory validation of waste plastics for industrial scale Advanced Recycling.
\$-value on waste.



| Feedstock | Oil yield | Chlorine (ppm) | Sulfur (ppm) | LFO (Diesel) Yield | Carbon Yield | Gas heat (kBTU/tonne) |
|-------------------------|-----------|----------------|--------------|--------------------|--------------|-----------------------|
| SWVic Polytunnel Spring | 0.7 | 300 | 100 | 0.6 | 0.15 | 0.8 |
| SWVic Polytunnel Summer | 0.75 | 500 | 150 | 0.65 | 0.15 | 0.6 |
| FNQ Banana film Spring | 0.8 | 200 | 80 | 0.7 | 0.1 | 0.7 |
| FNQ Banana film Summer | 0.79 | 100 | 100 | 0.69 | 0.1 | 0.4 |
| Adelaide oil bottle | 0.76 | 700 | 4000 | 0.66 | 0.1 | 0.9 |



Conclusion - sustainable life-cycles

- Advanced Recycling deals effectively with a wide range of ‘unrecyclable’ plastics.
- Pyrolysis technology is ready for implementation in Australia and our region.
- Broad-based support for industrial expansion a *pressing* need.
- A pipeline of high-value uses of AR products will lead to true circular economics.
- Post-use plastics must realise value beyond fuels or primary commodities for export.





Thank you

Ending Plastic Waste Mission/CSIRO Manufacturing

Michael Batten
Research Scientist

0434913216

michael.batten@csiro.au

<https://www.csiro.au/en/about/challenges-missions/Ending-plastic-waste>