'This research could see the production of a renewable resource using existing agricultural technology, that will enable farmers to value add their crops'

produced on a large scale for incorporation into salad dressings, margarine, juice, bread, milk, meat and eggs, and may provide people who don't like or want to eat fish, with a nutritious alternative. As there are not enough fish to sustain the current recommended dietary intake of PUFAs (2–3 serves per week), these products could also supplement the diets of fish consumers.

Similarly, plant-derived PUFAs could be used in aquaculture feed formulations, in combination with alternate protein sources such as lupin meal (*Ecos* 113), to reduce or replace the large quantities of wild fish that are ground up to provide the oil and protein needed to produce farmed fish.

While the project has only run for six months of a five-year vision, its potential is already apparent.

'This research could see the production of a renewable resource using existing agricultural technology, that will enable farmers to value add their crops, reduce pressure on fish stocks, sustain the growth in aquaculture, and provide more nutritious foods for human consumption,' Singh says.

● **Wendy Pyper**

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Waste plastic to clean fuel

An innovative solution, pioneered and commercialised in Japan, could help Australia reduce greenhouse gas emissions and the coal loads required by the iron and steel industries. Waste plastic will be used as a fuel in blast furnaces at ironworks, rather than heading for landfill, if a new scoping study by the Cooperative Research Centre for Coal in Sustainable Development (CCSD) confirms the process's feasibility.

In a traditional blast furnace, coal used to fuel the furnace acts as a 'reducing' agent for the conversion of iron oxide (FeO) into iron (Fe). This 'reduction reaction' occurs when carbon monoxide gas (CO), released from the burning coal, combines with the oxygen molecule from iron oxide to produce iron and carbon dioxide (CO_2). When plastic (a long chain hydrocarbon) is added, however, hydrogen molecules from the plastic combine with oxygen to produce water (H_2O), iron and reduced amounts of CO_2.

'This technology will only be practical in relative proximity to a blast furnace, of which there are three in Australia'

The plastic injection technology, successfully commercialised in Japan, helps reduce some 3.25 million tonnes of waste plastic buried in landfills each year. A ratio of about 10% plastic to coal is used in these commercial operations, but there is potential for this ratio to increase significantly. Before this happens, however, further research is needed to understand what happens inside a blast furnace when plastic is added.

The CCSD scoping study aiming to elucidate these unknowns is led by Professor Veena Sahajwalla of the University of New South Wales, in collaboration with BHP Billiton and Japanese scientists from Kyoto University and steel producer JFE.

'When you add plastic it changes the chemistry of the blast furnace,' Sahajwalla says.

'Water reacts more aggressively than carbon dioxide under high temperatures, and could cause other fuels in the furnace to degrade. So we need to identify the optimal ratio of plastic to coal and understand its impacts on the final product.'

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According to the Plastics and Chemicals Industries Association, more than one million tonnes of plastic was consumed in Australia in 2002. Of this, some 159 457 tonnes was recycled. The use of plastic as fuel in blast furnaces could help reduce its environmental impact.

The scoping study has not looked at chlorine-containing plastics, such as PVC, as these may generate undesirable by-products. However, Japanese scientists are working on this problem, the results of which could act as reference points for further development of the technology in Australia.

Estimates of the contribution of the technology to greenhouse gas reduction are currently being refined, as other 'eco-efficient' technologies are implemented concurrently.

The CCSD's chief executive Frank van Schagen says future development of the technology will consider how to source reliable plastic waste and who will pay for its collection and disposal. Because Australia is such a large country, collecting waste plastic on a national scale will be prohibitively expensive.

'This technology will only be practical in relative proximity to a blast furnace, of which there are three in Australia,' he says.

'However it is important to support research into this technology because, as customers for Australian coal increasingly adopt it, we need to understand the implications it will have on required coal properties and markets. The CCSD is also committed to the principles of increasing efficiency and reducing impact that underlie this technology.'

● Wendy Pyper

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