NOVEL AND SUSTAINABLE METHOD TO DEVELOP GREENER POLYMERS

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ABSTRACT

In recent years, polymers from renewable resources have become increasingly interesting due to their low cost, availability and possible biodegradability. More importantly by increasing the use of renewable resources we can potentially decrease the use of petrochemical feedstocks. Currently, epoxidised oils are produced from petrochemicals or by chemical epoxidation of fats and vegetable oils. Ironweed (*Vernonia galamensis sp*) is a prolifically growing natural plant in East Africa and it is receiving increasing attention due to it being one of a few plants containing naturally occurring epoxy oils in its seeds – 40% of vernonia oil (VO) by weight of the seed. VO is normally extracted with organic solvents such as hexane or petroleum ether. In this work, VO was extracted using an alternative solvent, supercritical carbon dioxide ($scCO_2$). $scCO_2$ offers several advantages such as mitigating risks from volatile organic solvents and its environmental compatibility. In addition, supercritical fluid extraction can be considered as a clean process to obtain oils since it gets less impurities than the oil extracted with organic fluids.

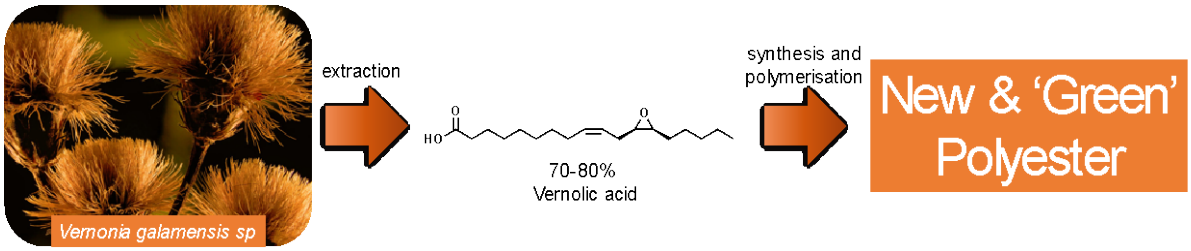

Fig. 1: Extraction of vernolic acid from *V galamensis* seeds using $scCO_2$ to produce a new and "green" polyester.

One of the main components of VO is vernolic acid (VA – 80% by weight of oil). The epoxy groups and double bonds from the triglyceride of VA offers great opportunities to modify it into a new monomer. Therefore, we purified the oil to obtain clean VA and we used "green" chemistry to convert it into a new monomer to be polymerised. Polycondensation reactions were performed under supercritical conditions allowing us to decrease the reaction temperature and viscosity. The effect of using a biocatalyst – *Candida antarctica* lipase B (CaLB), and a metal catalyst – tin octanoate ($Sn(Oct)_2$), were studied. There are several potential applications for these new and "green" biopolymers but we are mainly focused on designing surfactants to apply in the cosmetic industry.