

# Rosemary: A raw Material for a New Genre of Bio-based Antioxidants for Sustainable Applications

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## Abstract

The potential replacement, partially or fully, of synthetic additives by bio-based alternatives derived from indigenous renewable non-food crop resources offers a market opportunity for a green supply of raw materials for different industrial and health products, with greater involvement of the farming community in crop production while addressing the ever more stringent environmental and pollution laws that now require the use of less potentially toxic/harmful ingredients, even if they are present in relatively small quantities.

The work presented here relates to developing a new genre of environmentally-sustainable bio-based **antioxidants (AO)** for industrial uses that are obtained from extracts of UK-grown rosemary (*Rosmarinus officinalis*) plant. The performance of these AOs was tested, and their efficacy compared with some common and benchmark synthetic AOs from the same chemical class, in different products including polymers especially for packaging, as well as lubricants, cosmetics and health products.

One of the main active ingredients in rosemary is Rosmarinic acid which is a water-soluble compound. This was chemically transformed into a number of ester derivatives, Rosmarinates, targeted for different applications. The parent and the modified antioxidants (the rosmarinates) were characterised and their antioxidant activity was examined and tested in linear low-density polyethylene (LLDPE) and in polypropylene (PP) and compared with compounds of similar structure and with other well known synthetic antioxidants used commercially in polyolefins. The results show that antioxidants sourced from rosemary have the added benefit of being highly efficient and intrinsically more active than many synthetic and bio-based alternatives.