Green hydrolysis conversion of wool wastes into organic nitrogen fertilisers

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The European Union (EU) area has the second largest world sheep population, numbered to about 87 million (Source EU-Eurostat 2014). The EU flock is made of crossbred sheep not graded for fine wool production. The annual wool clip amounts to about 200000 t and its management is a specific problem for the EU livestock sector. Indeed, wool from sheep farming and butchery industry is very coarse and contains a lot of kems (dead fibres), making it practically unserviceable for the textile industry. Unserviceable wool is mostly disposed in landfills or illegally thrown over. Thus, shearing, storage, transportation and disposal of waste wool in accordance with current EU Regulation, heavily weigh on the profit of sheep farming. The Life+ 12 ENV/IT000439 GreenWoolF project aims at converting waste wool into nitrogen fertilizers at a commercial scale for grassland management and organic agriculture purposes. The chemical transformation is based on a green economically sustainable hydrolysis treatment using superheated water. The experiments were carried out in a semi-industrial reactor feeding superheated water and, due to condensation, the wool/superheated water system was maintained for different reaction times. The optimal conditions for this treatment were: 170°C for 60 min with a solid to liquor ratio close to 1. Chemical analyses such as amino acid analysis and molecular weight distribution performed on the hydrolysis products obtained revealed that the wool was completely degraded, the reaction product containing low molecular weight proteins and amino acids. Several product batches tested for germination showed an index higher than 100% without collateral phytotoxicity. The presence of amino acids, primary nutrients and micronutrients in wool hydrolyzates, along with a concentration of heavy metals below the standard limit, confirms the possibility of using wool hydrolyzates as nitrogen based ecologically sound fertilizer suitable for organic agriculture.

Figure 1: Scheme of the superheated water hydrolysis process

Biography
Marina Zoccola has been working since 1989 as a Researcher at the National Research Council, Institute for Macromolecular Studies, Textile section of Biella. Her principal interests are in the study and characterization of biopolymers, mainly structural proteins (wool, fine animal fibres, silk, human hair). She has participated in national and international research projects in the Textile and Biopolymer field. She was author of over 30 scientific works published in international journals.

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