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Superheated water hydrolysis of waste wool to obtain organic nitrogen fertilizers

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A large amount of coarse wool, practically unserviceable for textile use, is generated in Europe from sheep shearing and butchery. Such a byproduct is dumped, burned or sent to landfill. Following the European Commission regulations on animal byproduct control, unserviceable raw wool is classified as category 3 special waste materials. The collection, storage, transport, treatment, use and disposal of such unserviceable raw wool are subject to European Union regulations because of a potential risk to human and animal health. This study aims at converting the waste wool into nitrogen fertilizers at a commercial scale for grassland management and cultivation purposes. The chemical transformation of waste wool in to fertilizer 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. The wool/superheated water system was maintained for different reaction times. The optimal conditions for this treatment were as follows: 170 °C for 60 minutes with a solid to liquor ratio close to 1. The hydrolyzed product was analyzed using amino acid analysis and molecular weight distribution. Both the amino acid and molecular weight distribution analysis revealed that the wool was completely degraded and the hydrolyzed product contains a low molecular weight proteins and amino acids. Several hydrolyzed product obtained at different conditions were tested for germination which showed a germination 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.

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 fibers, silk, human hair). She has participated in national and international research projects in the textile and biopolymer field. She is the author of over 30 scientific works published in international journals.

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