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STEARATE FROM STEEL WIRE DRAWING PROCESSES AS A RESOURCE

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Abstract – Wire drawing processes are well established: steel wires are made by pulling wire rods through conically converging dies with gradually decreasing sections. As a result of the pulling force on the wire rods, the wire diameter is gradually reduced. Dry lubricants are needed for lubrication, as they form a thin layer between the wire and the die surface to prevent direct contact and reduce friction. Calcium and sodium stearate soap powders are mainly used as dry lubricants. With prolonged use, the concentration of metals like zinc, iron, calcium, and magnesium increases leading to contamination. Also, the burnt component in the soap powder increases, resulting in improper lubrication. Thus, fresh lubricant replaces the used dry lubricants that are collected and discarded. However, very few data are reported in literature about characterization and recycling of the used lubricant powder.

The aim of STAR (Stearato dai processi di Trafilatura del filo di Acciaio come Risorsa) project, funded by the Italian Ministry of the Environment, is the valorisation of stearate waste from wire drawing process in the production of new materials (material recovery) or as an energy source (energy recovery). To achieve this goal, a characterisation of stearate waste was performed. Samples of stearate waste were provided by wire drawing industries. The analyses showed that the humidity content was always low (0.1–5 %), while the volatile solids content varied from 2 % to 70 %, covering a very wide range and thus indicating a variable organic matter content. The results of the determinations of higher heating value and chemical oxygen demand correlated well with those of volatile solids, with an average of 26 MJ/kg and 500 mg O_2/g, respectively. Measurements also confirmed that the used lubricants have a basic pH (> 11). Anaerobic digestion can surely have an important role in valorisation, as it allows to recover energy and to produce a stabilized digestate for which a further use can be studied, according to its properties. Despite the potential limits in biogas production observed for fatty acids, preliminary tests determined a biomethane production in the range 500–900 L/kgVS, much higher than the production from animal waste (around 400 L/kgVS). The toxicity of the digestate was assessed by Microtox® assay and was negligible. This finding supports the hypothesis that recalcitrant compounds, which do not undergo degradation in anaerobic conditions, are not toxic.

Keywords – BMP (biomethane production); characterization; material recovery; stearate waste

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