PERSONAL PROTECTIVE EQUIPMENT (PPE) WASTE VALORISATION VIA PYROLYSIS: FACE MASKS AND NITRILE GLOVES PRODUCTS CHARACTERISATION AND CHALLENGES

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Used surgical masks and nitrile gloves represent the most common personal protective equipment (PPE) waste, which on one hand poses environmental and pollution issues ending up often in landfills or requiring incineration due to the lack of dedicated recycling technologies, but on the other hand represent an excellent raw material for fuels/chemicals production via reverse engineering due to their high hydrogen and carbon content and high heating value [1].

Pyrolysis, the decomposition of organics in the absence of oxygen under temperatures around 400-600°C is gaining attention as an alternative disposal technique for PPE due to its relative flexibility, high conversion efficiency, lower environmental impact (compared to incineration) and the possibility to generate valuable products like hydrocarbon rich oils to enter refineries for further hydro-processing [2].

Despite extensive work being conducted on face masks and plastic waste pyrolysis in general in the past few years, there is lack of knowledge on the pyrolysis products of mixed nitrile gloves / masks and how pyrolysis conditions affect their yield, oil composition and synergistic pyrolysis mechanism, which require further investigation [3-5].

This work, which stems from a recent collaboration between Heriot-Watt University and Globus Group, the largest provider of PPE in the UK, aims to (i) evaluate the slow pyrolysis of face masks and nitrile gloves under different temperatures, gas residence times and feedstock compositions and (ii) discuss the main challenges for the PPE waste pyrolysis oil applications, with particular focus on emission of harmful gases (e.g. HCN, HCl) that poses great threat to public health and the environment and the presence of undesired contaminants in the oils (e.g. metals, N, S, PAHs), which limits their access to refinery settings.

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