VALORIZATION OF ENERGETIC MATERIAL FROM AMMUNITION IN CIVIL EXPLOSIVES

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Ammunitions that have reached the end of life (or become obsolete) are considered hazardous waste. The Armed Forces have significant amounts of ammunition (a residue with high energy content) that need to be eliminated. Currently, in Portugal and other developed countries, ammunition is disposed of in incinicators with sophisticated gas treatment systems; however, this decommissioning process has important limitations in terms of incinicator capacity, high costs and energy requirements (Ferreira et al., 2013). This paper describes the valorization of ammunition by incorporation into civil explosives, as an alternative to conventional decommissioning. Therefore, the main goal of this paper is to assess the potential energy and environmental benefits of incorporating energetic material in ammonium nitrate (AN) based emulsions, civil explosives widely used for mining and road construction, allowing for the displacement of both disposal of military explosives and production of an equivalent quantity of civil explosives.

Previous work involving experiments with energetic material incorporated in AN emulsion has shown that a simple processing technique (grinding) is sufficient to blend the energetic material into the emulsion matrix, with no formation of new chemical species. A life-cycle model has been implemented based on primary data for the grinding process and on previous studies on conventional decommissioning processes (Ferreira et al., 2013) and production of ammonium nitrate emulsion (Ferreira et al., 2015). The model implemented follows the “avoided burdens” approach to calculate the environmental burdens avoided when 1 kg of TNT equivalent from ammunition is incorporated into civil explosives. Results were calculated based on three complementary life-cycle impact assessment methods: primary energy, six environmental impact categories (CML), and three toxicological categories (USEtox). The results show that re-using ammunition through valorization of energetic material has considerably lower impacts (approximately 80% for all categories) compared to conventional decommissioning, mainly due to avoided incineration and gas treatment.