NITRILE CHEMISTRY : CAN INNOVATION LEAD US INTO MORE SUSTAINABLE ENVIROMENT?

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Extended Abstract

Carboxylated nitrile butadiene rubber, XNBR has been used in rubber dipping industry for more than few decades. It has been evolved in line with the industrial sustainability as well as the market application requirements. According to a recent market survey conducted by Synthomer, about 317 billion pieces of glove are produced globally and approximately 75% channelled to thin disposable application and the rest spread between reusable, surgical and industrial usage [1]. With the increasing number of application for nitrile globally, the awareness in term of sustainability is becoming a necessity. There are several initiatives found in the industry with regards to the aspect of sustainability. Nitrile gloves recycling initiative from Kimberly Clarke [2] and some scientists [3].

Figure 1 : Nitrile glove recycling conceptual diagram flow[2]

Introduction of biodegradable nitrile gloves is also another green initiative in the industry [4]. The question being asked is how are we going to judge the sustainability and eco-efficiency? Is that a baseline benchmark for us to refer to? In this context, a comprehensive eco-efficiency assessment will be needed. Eco-efficiency assessment makes use of eco-efficiency indicators to discover more economic and effective ways to improve productivity process and to

enhance recyclability or reducing energy and material intensity [5]. Life Cycle Assessment, LCA can be one of the good tool for this purpose. LCA is a methodology ruled by ISO (14040, 14044) standards [6,7] that enables the evaluation of potential environmental impacts, for a series of impact categories including climate change, eutrophication or human health issues, of a product system. LCA encompasses all life cycle steps of the studied system, from raw material extraction to end-of-life treatments, including production phase, use phase and transports. A LCA study involves four steps: definition of goal and scope of the study, establishment of the inventory, impact calculation and interpretation. All exchanges between the studied system and the environment are compiled during the inventory step, and those flows are translated into environmental impacts through consensually approved scientific calculation methods [8]. There are several published reports/ articles share the example of use of LCA as an indicator to evaluate environmentally the rubber and/or rubber related products [9-12]. Jewell et al reported a comparative LCA of radioactive protective garments and compare the reusable and disposable product in this application [10]. Among the gloves related studies, final report from MARGMA and SIRIM back in 2013 was the most relevant to rubber gloves and it compares between natural rubber and nitrile disposable gloves [13]. This serves as one of the early reference with regards to sustainability in the industry. With the industry and technology moving on, have those innovations introduced help in contributing to the sustainability of rubber glove industry?

In this paper, we will make use of LCA as an indicator to evaluate the environmental relevance with regards to evolution of nitrile technology to address question such as competitiveness, in terms of sustainability, against type of rubber gloves for the same application. Comparison will also include the full glove performance evaluation to define further the life-time uses in the selected application.

The environmental hotspots discovered during the LCA exercise will also being discussed to provide insight and direction to allow the focus of eco-design effort in order to achieve the best possible environmental and sustainability optimization in the industry.

At the time of extended abstract submission, the experiment is still in progress. Full information will be presented during oral presentation.

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