First international conference on composites, biocomposites and nanocomposites, DUT, Durban, South Africa, 2-4 December 2013

# SCREENING LIFE CYCLE ASSESSMENT STUDY OFA SISAL FIBRE REINFORCED MICRO-CONCRETE STRUCTURAL INSULATED PANEL

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## ABSTRACT

The building industry consumes 50% of the raw materials extracted from the Earth's crust annually and also plays a leading role in environmental pollution. Replacing synthetic materials with bio-composites has been shown to yield environmental benefits and also save costs. Such an approach will therefore place the building industry on a more sustainable path. This paper reports on a screening life cycle assessment (LCA) study of a sisal fibre reinforced (SFR) micro-concrete structural insulated panel (SIP) that is being developed for building envelope applications. The study aimed to identify the environmental benefits, if any, of substituting 50% of ordinary Portland cement with an equivalent mass of calcined clay; predict the overall environmental impacts of manufacturing the proposed SFR micro concrete SIP; and identify viable options for improving on the predicted performance. The scope is limited to a cradle-to-gate analysis. The functional unit is one SFR micro-concrete SIP. The product system of the SIP includes six constituent materials - sisal fibre, Ordinary Portland cement (OPC), calcined clay, a superplasticizing admixture, phenol formaldehyde (PF) and expanded polystyrene (EPS). The contribution of the SIP to global environmental impacts; regional environmental impacts; and toxicity was investigated. The main findings are that (i) substituting 50% of OPC with calcined clay will result in significant savings (in terms of avoided environmental impacts) (ii) further research should focus on identifying environmentally benign substitutes for phenol formaldehyde and the superplasticizer because these two materials make very high contributions to toxicity (iii) The arable land area required for crop cultivation, and the energy requirements of fibre processing are two weak points in the cradle-to-gate life cycle of sisal. Further research should focus on sisal farming on non-arable; development of sisal cultivars which will maximise the sisal fibre yield per hectare; and conversion of sisal plant residues to bio-energy to be used in the fibre extraction processes.