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Uporaba odpadne električne in elektronske plastike za delno nadomeščanje agregatov v betonih

The use of Waste Electrical and Electronic Plastic as Partial Replacement for Aggregates in Concrete

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POVZETEK

Odpadna električna in elektronska oprema (OEEO) predstavlja enega izmed največjih masnih tokov odpadkov na mednarodni ravni in tudi v Južni Afriki, ki ima pomembne socialne in okoljske vplive. Kljub temu, je bilo v letu 2016 dokumentiranih samo 20% kar je 44,7 milijonov ton vseh nastalih količin OEEO v procese recikliranja, medtem ko je Južna Afrika dokumentirala, da je bilo v letu 2012 recikliranih le 11% vseh letno nastalih količin OEEO. Južno Afriška podjetja, kjer nastajajo OEEO, izvažajo približno 90% tiskanih vezij, 60% fosfornega prahu in 80% odpadne električne in elektronske plastike.

OEEO vsebuje potencialno škodljive toksine, kot so: berilij, kadmij, krom, svinec, živo srebro in selen med ostalimi. Recikliranje OEEO je kompleksno zaradi prisotnosti različnih dodatkov nevarnih snovi, različnih vrst plastičnih mas, degradiranih polimerov, zaviralcev gorenja in široke palete termoplastov, ki jih najdemo v OEEO.

V članku bo predstavljena raziskava uporabe OEEO za delno zamenjavo agregatov v betonih. Ocenjena je tlačna trdnost, natezna cepilna trdnost in obstojnost betona z uporabo enake kombinacije ABS (akrilonitril-butadien-stirena), PC + ABS (polikarbonat in akrilonitril-butadien-stirena) in HIPS (polistirena z velikim vplivom). Z raziskavami je bilo ugotovljeno, da ima do 30% nadomeščanje agregata z OEEO 30% minimalen vpliv na strukturno trdnost betonov, ki je zahtevana v gradbeni praksi. Zato bi bilo potrebno dodatno raziskati vpliv nadomeščanja agregatov z OEEO v betonih.

Ključne besede: odpadna električna in elektronska oprema, recikliranje, gospodarjenje z odpadki.

ABSTRACT

Waste electrical and electronic equipment (WEEE) is one of the largest flowing waste streams internationally and in South Africa with significant social and environmental implications. However, only 20% of the world's 44.7 million metric ton WEEE was documented for recycling in 2016, while South Africa documented that only 11% of its total annual WEEE was recycled in 2012. WEEE companies in South Africa export approximately 90% printed circuit boards, 60% phosphorous powders and 80% of waste electrical and electronic plastics (WEEP).

WEEE contains potentially harmful toxins, such as: beryllium, cadmium, chrome, lead, mercury and selenium among other. WEEP recycling is complex due to the presence of different hazardous additives, variety in plastic types, degraded polymers, flame retardants and a wide range of thermoplastics found in WEEP.

This paper describes an investigation involving the utilisation of WEEP as partial replacement for aggregates in concrete. The compressive strength, tensile splitting strength and durability of concrete made using an equal combination of ABS (acrylonitrile-butadiene-styrene), PC+ABS (polycarbonate and acrylonitrile-butadiene-styrene) and HIPS (high impact polystyrene), has been evaluated. It was found that 30% WEEP replacement levels would produce concrete with the minimum structural strengths required for application in construction practice. Therefore, there is a need to further explore the influence of WEEP replacement in concrete.

Key words: Waste electrical and electronic equipment (WEEE), recycling, waste management.