Linseed Oil-based Cross-linked Polyphosphate Composite Films

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Nowadays more people care for environment and since the oil resources are decreasing and prices are increasing very fast, scientists are looking for polymers and polymer composites from renewable materials. For now most widely used polymers, from renewable sources, are polysacharides and enzymes. Vegetable fat are widelly applied for polymer synthesis, as they are widespread, cheap, biodegradable and can be modified into various products, as a result, widely applied [1-4].

In this work, biodegradable polymer composite films were formed from polymeric binder, cross-linked linseed oil-based polyphosphate, using various natural fillers. As filler: horn meal, phosphogypsum, rapeseed cake, pine needles, pine bark, grain mill waste or mixture of grain waste and weed, were used. Cross-linked polyphosphate was obtained by mixing of epoxydized linseed oil and aqueous solution of 1-hydroxyethane-1,1-diphosphonic acid without any catalyst and organic solvents[2]. Polymeric composite films were formed by casting of reaction mixture of polymeric binder starting materials and natural fillers on substrate. Such polymer composite films can be formed directly on soil and used as mulching films in agriculture and forestry.

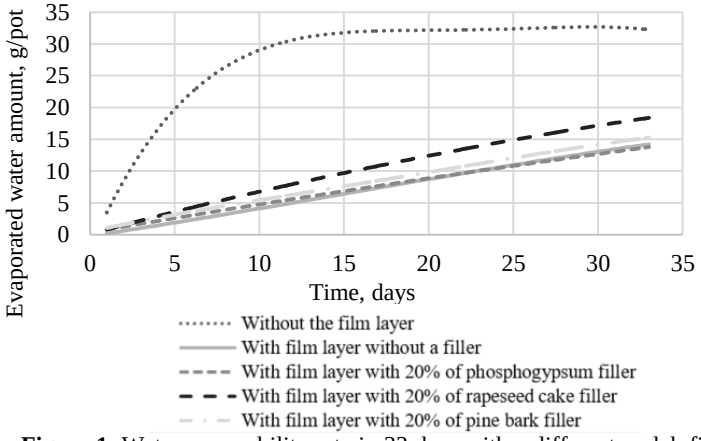

Figure 1: Water permeability rate in 33 days with a different mulch film layers: without film layer, with film layer without a filler, with film layer with 20% phosphogypsum, with film layer with 20% rapeseed cake filler and with film layer with 20% pine bark filler.

Dependency of composite curing time on temperature, dilution, filler type and amount – was examined. Furthermore, mechanical and thermal properties, combustibility, moisture permeability (Figure 1 and 2), surface wetting, swelling in water, and biodegradability, of formed polymeric composite films, were investigated. Linseed oil-based cross-linked polyphosphate composite films can be formed in one day at 25°C, their mechanical, thermal properties and permeability allows them to be used for mulching, even more, they are capable to keep moisture in the soil, are biodegradable and compostable.

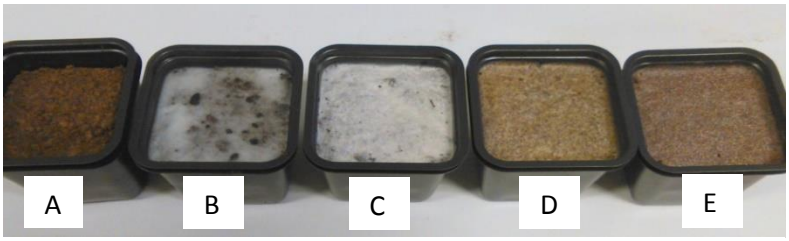

Figure 2: Photo of polymer layers on the soil in the pots. A – pot without film layer, B – pot with film layer without a filler, C – pot with film layer with 20% phosphogypsum, D – pot with film layer with 20% rapeseed cake filler and E – pot with film layer with 20% pine bark filler.

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