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# CONTROLLED RELEASE FORMULATIONS of AUXINIC HERBICIDES

Witold J. Kowalski (1), Andrzej. Siłowiecki (2), Iwona Romanowska (3), Mariola Glazek (2), Justyna Bajor (1), Katarzyna Cieciwa (1), and Piotr Rychter (1)

(1) Jan Dlugosz Uniwersity, Chemistry, Environmental Protection & Biotechnology, Czestochowa, Poland (wjk@interia.pl), (2) Institute of Plant Protection, Sośnicowice Branch, Sośnicowice, Poland, (3) Centre of Polymer and Carbon Materials, Polish Academy of Sciences, Zabrze, Poland

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Controlled release formulations are applied extensively for the release of active ingredients such as plant protection agents and fertilizers in response to growing concern for ecological problems associated with increased use of plant protection chemicals required for intensive agricultural practices [1].
We synthesized oligomeric mixtures of (R,S)-3-hydroxy butyric acid chemically bonded with 2,4-D, Dicamba and MCPA herbicides (HBA) respectively, and determined their molecular structure and molecular weight dispersion by the size exclusion chromatography, proton magnetic resonance spectrometry and electro-spray ionization mass spectrometry. Further we carried out bioassays of herbicidal effectiveness of the HBA herbicides vs. series of dicotyledonous weeds and crop injury tests [2, 3, 4]. Field bioassays were accomplished according to the EPPO standards [5]. Groups of representative weeds (the development stages in the BCCH scale: 10 – 30) were selected as targets. Statistical variabilities were assessed by the Fisher LSD test for plants treated with the studied herbicides in form of HBA oligomers, the reference herbicides in form of dimethyl ammonium salts (DMA), and untreated plants. No statistically significant differences in the crop injuries caused by the HBA vs. the DMA reference formulation were observed. The effectiveness of the HBA herbicides was lower through the initial period (ca. 2 weeks) relative to the DMA salts, but a significant increase in the effectiveness of the HBA systems followed during the remaining fraction of each assay. After 6 weeks all observed efficiencies approached 100%. The death of weeds treated with the HBA herbicides was delayed when compared with the DMA reference herbicides. The delayed uptake observed for the HBA oligomers relative to the DMA salts was due to controlled release phenomena. In case of the DMA salts the total amount of active ingredients was available at the target site. By contrast, the amount of an active ingredient in the HBA oligomers was chemically bound to the oligomer matrix and a controlled release followed in concert with the hydrolysis of ester bonds in the oligomer systems.
Due to the high volatility and high water solubility of the DMA salts, significant amounts of active ingredients were predisposed to be dispersed in the environment. On the other hand, the HBA oligomers exhibit low volatility and low solubility in water, so they tend to exhibit lover migrating rates from the target site. The obtained plots suggested that in the case of the HBA oligomers the effectiveness were delayed in time when compared with the DMA salts.
The integral effectiveness of the studied HBA oligomers was practically equivalent to the conventional DMA salts, but the release of the HBA herbicides was delayed in time vs. DMA salts. The mixtures of oligo (R,S)-3-hydroxybutyric acid containing chemically bonded 2,4-D, Dicamba and MCPA (HBA) were proposed as carriers of active ingredients that could be released to control the sensitive weeds. The synthesized HBA oligomers could be particularly useful in a number of practical applications, because they release the herbicide to plants at a controlled rate and in amounts required over a specified period of time, their degradation products are identical to metabolites formed in plant cells, the physicochemical and operational parameters of the carrier oligomers might be optimized by fine-tuning of synthesis conditions. The decreased vapor pressure and increased lipophilicity of the studied materials could reduce the risk exposure of the operational personnel, as well as, a decrease the environmental pollution.

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