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Assessment of the migration of organic deterrent in nitrocellulose

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The impregnation in surface with combustion moderator (called also deterrent) is usually applied to improve the ballistic properties; for example in the case of ball propellants which are widely used in small calibre weapons. The inconvenient of this surface impregnation is the migration of the deterrent towards the centre of the grains. The knowledge of the diffusion coefficient of deterrent into grain core during the lifetime of the propellant is of significant importance because it is a fitting factor for the estimation of the shelf life. Diffusion coefficient has been determined by various techniques. In the most recent articles, we find that the most employed method is infrared (IR) microscopy. In this paper, we expose a new procedure based on well-known experimental technique namely high pressure liquid chromatography (HPLC) and composed of the following steps: first the preparation of propellant grains that have cylindrical shape and double base chemical composition (around 11% nitroglycerin) using extrusion process, then a known quantities of deterrent (dibutyl phthalate; DBP) are deposited on the surfaces perpendicular to the axis of the grains before conditioning them at constant temperature (85°C) for 24 hours. After that, each grain is cut by a microtome into small slices (thickness 20 μm). The last step comprises of the determination of the concentration in DBP of each slice by HPLC. The results permit the determination of the concentration distribution and the diffusion coefficient of DBP in grain matrix.