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Characterization of granular activated carbons used in rum production based on immersion bubble-metric and acoustic emission analysis

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Optical microscopy, acoustic emission analysis and sound patterns recognition techniques were applied for the characterization of granular activated carbon (GAC). New methodologies have been developed to determine the exhaustion degree of GAC used in the rum production: based on the acoustic emission analysis of the sound produced by water flooded on GAC and based on the microscopic analysis of bubbles formed by immersion into glycerol. Acoustic measurements are made in a specific set-up, bubble detection and analysis is performed using dedicated software developed in MATLAB® for circular shape pattern detection based on the Hough transform. Both have been correlated with data of GAC characteristics based on thermogravimetric analysis (TGA), CHNS-O elemental analysis, ¹H-NMR T2-relaxometry and Thermal Desorption-Gas Chromatography Mass Spectrometry (TD-GC/MS). Eight GAC used in the rum production and sampled at different depth within the fixed bed filter (different exhaustion degree) have been evaluated. Good correlations are found between the immersion bubble-metric technique, the acoustic measurement data from the original signal processed by band-pass (BP) filtering at 1.3 kHz and amounts of adsorbed compounds on the GAC. All methods are even suitable for determining the exhausted degree of GAC used in rum production which is not possible using conventional gas adsorption methods. The acoustic emission and bubble-metric methods are fast and sensitive, can be performed quickly and relative easily, in view of an in-time controlling strategy needed within the rum production process. The found relationship not only gives the possibility to determine the exhaustion degree of GAC in rum production but also opens new horizons to evaluate high-porosity materials.

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