Experimental investigation of the performances of a wet separation process for traditional and bio-plastics

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HIGHLIGHTS

• A wet technology for plastic mixture classification was setup.
• Image analysis allowed detecting the velocity field and identifying the main flow structure.
• This technique was also employed to study the behavior of mixtures of plastic particles and passive tracer to understand the coupling regime.
• The fluid exerts an influence on the plastic particle and the opposite occurs too.
• Remarkable separation results were obtained for PET-PVC, PET-PC and PVC-PC mixtures.

ABSTRACT

The hydraulic separator is a device employing a wet technology for particle separation. Due to the combination of a characteristic flow pattern developing within the apparatus and density, shape and size differences among two or more polymers, it allows their separation into two products, one collected within the instrument and the other one expelled through its outlet ducts. The geometry of the channel allows the formation of recirculation areas that play a major role in the material separation. The characteristic dimensions of those areas and their interaction with the main advective flow depend on the apparatus internal shape. As the geometry of the apparatus is one of the key elements to characterize the device separation capability, two different arrangements were examined. The kinematic investigation of the fluid flowing within the apparatus seeded with a passive tracer was conducted via image analysis. This technique was also employed to study the behavior of mixtures of plastic particles and passive tracer to understand the coupling regime between the flow field and plastic particles. For the operating conditions tested, two-way coupling takes place, i.e., the fluid exerts an influence on the plastic particle and the opposite occurs too.

Fig. 1 Eulerian velocity vectors overlapped onto the colormap of the horizontal velocity component (left-hand side image), of the vertical velocity component (central image) and of the two-dimensional turbulent kinetic energy (right-hand side image) in C3 for a flow rate equal to 0.92 10⁻³ m/s.