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A Novel 10-100g Distributive and Dispersive Minimixer: Data and Analysis

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This paper describes a novel laboatory mixer which can reproduce the distributive and dispersive mixing achieved in large co-rotating screw extruder but in a very small device holding typically 10 to 100g of material. This invention provides a new opportunity to develop new products quickly, safely and cheaply. The application is not restricted to polymers and can be extended to other viscous materials. It has also other spin-offs particularly as a research tool for studying mixing and developing new, more efficient, mixing flows.

The principle of operation of this device is based on combining two opposing flows: a single screw extruder circulation flow with a twin screw extruder mixing flow. The mixing is carried out as a batch but on its completion, the single screw extruder flow is reversed and becomes co-current with the twin extruder flow to enable the discharging of the batch through a die.

In the paper we will present mixing data obtained with various colour pigments in polymers used for colour masterbatch. In the experimental study , we effectively produce plastic masterbatch formulations with this minimixer under different conditions of screw and mixing element speeds, mixing time and rheology of the viscous mass. The quality of mixing was measured using image analysis of microtome sections of the extrudate obtained from this min-mixer and of blown film samples coloured with this masterbatch.

In addition to presenting data, we will also underpin the operation of this new mixer with a theoretical analysis that quantifies the levels of shear and elongation mixing that occurs within it. The ultimate aim is to enable an optimum design to be obtained for this new device.