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Abstract
In this experimental study, binary collisions of a diesel oil drop with a water drop and a diesel oil drop with an ethanol drop were observed. The former represented collisions between equal-sized immiscible drops with large surface tension difference and the latter represented collisions between equal-sized immiscible drops with small surface tension difference.

The collision outcomes were controlled by two dimensionless groups: the Weber number and the impact parameter. In both diesel-water and diesel-ethanol collisions, bouncing, coalescence, and stretching separation were observed. However, the conventional reflex separation was observed in a diesel-ethanol collision but not in a diesel-water collision; whereas a newly-defined single reflex separation was observed in a diesel-water collision but not in a diesel-ethanol collision. This distinction was attributed to the surface tension difference between the two collided drops.

In comparison with a diesel-diesel drop collision, a diesel-water collision ceased to coalesce at a lower Weber number and separate, in stretching separation mode, easier at a smaller impact parameter; while a diesel-ethanol collision separated, in a reflex separation mode, at a lower Weber number and separated, in a stretching separation mode, at a higher impact parameter.
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