# Researchers unveil the origin of Oobleck waves

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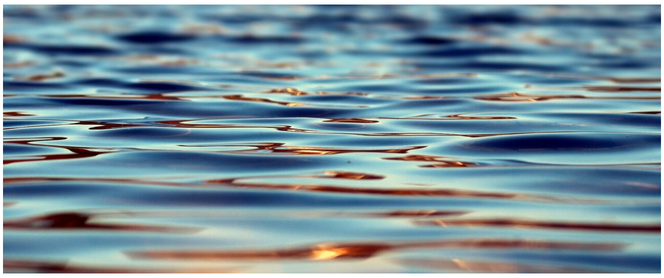

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"Oobleck" is a strange fluid made of equal parts of cornstarch and water. It flows like milk when gently stirred, but turns rock-solid when impacted at high speed. This fascinating phenomenon, known as shear-thickening, results in spectacular demonstrations like running on a pool of Oobleck without submerging into it, as long as the runner doesn't stop.

Researchers from Aix-Marseille University in France have now studied the regular and prominent surface waves that form when a Oobleck flows down an inclined slope (see Figure 1). Similar waves can be observed on gutters and windows on rainy days. However, the scientists noted qualitative differences with water waves; waves in Oobleck grow and saturate much faster. In order to unveil the origin of Oobleck waves, they conducted careful experiments with a mixture of cornstarch and water down an inclined plane.

The researchers measured the onset of wave appearance and their speed using controlled perturbation of the flow and laser detection to estimate the fluid film thickness. These experiments revealed that for concentrated Oobleck, the onset of destabilization is different for destabilization in a Newtonian fluid such as water. This surprising observation led the team to look for a scenario to explain their formation. Their results are presented in a paper published on December 18 in *Communication Physics*. In this article, they conclude that for Oobleck, waves do not arise from the effect of inertia, as for water, but from Oobleck's specific flowing properties.

Under impact, as shown by recent studies, Oobleck suddenly changes from liquid to solid because of the activation of frictional contacts between the starch particles. When flowing down a slope, this proliferation of frictional contacts leads to a very curious behavior: The flow velocity of the suspension decreased when the imposed stress increased—like stepping on the gas pedal causing a car to decelerate. Researchers have shown that this effect couples to the flow free surface and can spontaneously generate a regular wave pattern.

The proposed mechanism is generic. These findings could thus provide new grounds to understand other flow instabilities observed in various configurations, particularly in industrial processes facing problematic flow instabilities when conveying Oobleck-like materials such as concrete, chocolate or vinyl materials.

**More information:** Baptiste Darbois Texier et al. Surface-wave instability without inertia in shear-thickening suspensions, *Communications Physics* (2020). DOI: 10.1038/s42005-020-00500-4

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