Salt deposit ring inside your pasta pan? Researchers unveil the physical mechanisms at play

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Releasing a handful of salt into a pasta pan can result in a circular ring deposit, which shows the sedimentation history of the particle cloud. Credit: Mathieu Souzy

If you've ever tossed a generous pinch of salt into your pasta pan's water for flavor or as an attempt to make it boil faster, you've likely ended up

with a whitish ring of deposits inside the pan.

A group of scientists from the University of Twente in the Netherlands and the French National Institute for Agriculture, Food, and Environment (INRAE), inspired by this observation during an evening of board games and pasta dinner, wondered what it would take to create the most beautiful salt ring inside the pasta pan: Would you need to throw in small salt grains or large ones? In what quantity and how fast? Is there an optimal amount of water inside the pan?

In *Physics of Fluids*, the group reports their findings about what causes these peculiar salt particle cloud deposits to form. Their experiment is simple to set up, easily reproducible, and inexpensive.

"By the end of our meal, we'd sketched an experimental protocol and written a succession of experiments we wanted to try on my youngest son's small whiteboard," said Mathieu Souzy. "It was a great overall experience, because we soon realized our simple observation of daily life conceals a rich variety of physical mechanisms."

So what's really going on within the pan? When a single particle is released into a tank of water, it settles to the bottom due to gravity and creates a small wake drag that perturbs the flow of water around it.

"If a large number of particles are released at the same time, neighboring particles experience this flow perturbation generated by all surrounding particles," said Souzy. "It causes sedimenting (falling) particles to be progressively shifted horizontally, which leads to an expanding circular distribution of the particles."

When particles reach the bottom rapidly, they form a circular deposit, and the water entrained within the wake of the cloud of particles further pushes the particles radially away. This creates a clean central depletion

region.

But if particles are released from a greater height, they sediment (fall) for a longer time and the cloud of particles expands radially—until there's a large enough space between particles so that the flow perturbations induced by their fellow sedimenting/falling particles become negligible and particles are no longer close enough to form a "cloud." Then, particles essentially rain down to form a homogeneous circular deposit.

"These are the main physical ingredients, and despite its apparent simplicity, this phenomenon encompasses a wide range of physical concepts such as sedimentation, non-creeping flow, long-range interactions between multiple bodies, and wake entrainment," said Souzy.

"Things get even more interesting once you realize larger particles are more radially shifted than small ones, which means you can sort particles by size just by dropping them into a water tank."

And yes, Souzy can "create very nice salt rings almost every time" he cooks now.

More information: Salt-ring in your pasta pan: Morphology of particle cloud deposits, *Physics of Fluids* (2025). DOI: 10.1063/5.0239386

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