

Mechanism of wine swirling explained

November 21 2011



Wine drinkers know that swirling a good vintage around in a glass aerates the wine and releases its bouquet. Just how the process – known as "orbital shaking" – works, however, has been something of a mystery.

Fluid dynamicists have long observed that orbital shaking generates a wave that propagates around the inner edge of the [glass](#), churning the liquid as it travels. "The formation of this wave has probably been known since the introduction of glass or any other kind of cylindrical bowl, but what has been lacking is a description of the physics related to the [mixing](#) and oxygenation," says Mohamed Farhat, senior scientist at the Ecole Polytechnique Federale de Lausanne in Switzerland.

To figure out how the mixing occurs, Farhat and his colleagues

generated such waves in clear cylinders and used state-of-the-art instrumentation to track the motion of traveling waves and measure the liquid velocity.

The researchers found that "as the wave propagates along the glass wall, the liquid is displaced back and forth from bottom to top and from the center to the periphery," Farhat explains. "This pumping mechanism, induced by the wave, is more pronounced near the free surface and close to the wall, which enhances the mixing." The research team also discovered that, "for a given glass shape, the mixing and oxygenation may be optimized with an appropriate choice of shaking diameter and rotation speed," he says.

"The intuitive and efficient motion of wine swirling has inspired engineers in the field of biopharmaceuticals," Farhat says, where cell cultures can be placed in large cylindrical containers – or bioreactors – and "shaken" in a manner similar to the aeration of a glass of wine. The new work, he says, demonstrates that "such bioreactors offer better mixing and oxygenation over existing stirred tanks, provided that operating parameters are carefully optimized. Moreover, the gentle nature of orbital shaking also ensures a better viability and growth rate of the cells at reduced cost."

Martino Reclari, a Ph.D. student and a member of the Swiss team, will present the findings in a talk at the American Physical Society's Division of Fluid Dynamics Meeting, which will take place Nov. 20-22, 2011, at the Baltimore Convention Center in the historic waterfront district of Baltimore, Maryland.

More information: The talk, "'Oenodynamic': hydrodynamics of wine swirling," is on Monday, Nov. 21. Abstract: absimage.aps.org/image/MWS_DFD11-2011-002246.pdf

Provided by American Institute of Physics

Citation: Mechanism of wine swirling explained (2011, November 21) retrieved 26 April 2024
from <https://phys.org/news/2011-11-mechanism-wine-swirling.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.