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Flow Dynamics of a smart pump: Mytilus Galloprovincialis KAREM PEKKAN, FAZIL USLU, Koc University, BIOFLUIDS AND CARDIOVASCULAR FLUID MECHANICS LABORATORY TEAM — Hydrodynamic performance of marine mussel, Mytilus Galloprovincialis, is studied by the time-resolved particle image velocimetry (PIV). We evaluated inhalant flow, exhalant jet flow, pumping performances, and flow control capabilities of the mussels quantitatively. Inhalant flow structures of mussels are measured at the coronal plane first-time in literature. Nutrient fluid is convected into the mussel by three-dimensional sink type flow that is different than exhalant jet flow. Inhalant velocity reaches its highest magnitude inside of the mussel mantle while accelerating outward the mussel. We calculated pressure gradient at the coronal plane where three-dimensional sink type inhalant flow is observed. As inhalant flow approaches mussel shell tip, suction force generated by the inhalant flow increases. Likewise, unique exhalant jet flow regimes are studied for 17 mussels. Mussels can control their exhalant jet flow structure from single potential core region to double one or vice versa. Peak exhalant jet velocity generated by the mussels changes between 2.77 cm/s and 11.1 cm/s as a function of mussel cavity volume. Hydrodynamic dissipation at sagittal plane is calculated to evaluate whether there is any interference between inhalant sink flow and exhalant jet flow or not. Results showed an efficient synchronized pumping mechanism. This pumping mechanism can feature flow-turning angle, the angle between inhalant and exhalant jet flow, 90with standard deviation of 16.

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