Effects of flows on transparent exopolymer particle release by branching corals

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Transparent exopolymer particles (TEP) are released by corals as a major component of mucus. TEP induce particle aggregation and marine snow formation, thus significantly contribute to the vertical carbon cycling in reef ecosystems. The induced aggregates can also serve as an energy source for microorganisms such as bacteria.

While previous studies mostly investigated organic matter release by reef-building corals with a special focus on organic carbon, TEP release from corals has yet to be quantified, despite its importance.

Through systematic laboratory flume experiments, we quantified TEP release by branching *Acropora* corals and assessed the associated bacterial growth under different flow speeds. The experimental section of a recirculating flume was covered with branching corals and the coral colonies were exposed to unidirectional flows with mean flow speeds of 0, 5, 10, and 30 cm/s at 25˚C. We evaluated the TEP release and bacterial growth during the incubations and measured detailed flow fields using particle image velocimetry (PIV) to estimate the turbulent mixing efficiency above the coral canopy.

In the 24-hour incubations, *Acropora* corals released significantly more TEP (9.4 times) in the absence of water flows compared to those in flow speeds of 5—30 cm/s. Bacterial growth was also significantly higher (4.4 times) in the case without water flows. While the material exchange efficiency linearly increased with mean flow speeds, TEP release and bacterial growth in 5, 10, and 30 cm/s flows were not significantly different from each other, suggesting equal amounts of TEP release under these flows.

Our findings suggest that TEP release by corals and bacterial growth are strongly influenced by the state of oceanic flows, which highlights the importance of considering these factors when estimating the biogeochemistry in coral reefs.

Keywords: transparent exopolymer particles (TEP) , coral, particle image velocimetry (PIV), flume experiment, turbulent mixing, coral mucus