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# Ingestion of Crumb Rubber and Uptake of Associated Contaminants in Lumpfish (*Cyclopterus lumpus*)

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## Abstract

Car tire rubber represents an important source of microplastics, mainly through abrasion of tire dust on roads, but also in the form of crumb rubber (CR) produced from end-of-life vehicle tires that is used in artificial sport fields, playgrounds and other urban surfaces. CR is known to contain a mixture of different organic chemicals and metals. The leachate of tire particles has previously been shown to be toxic to marine invertebrates and some fish species. Here, lumpfish (*Cyclopterus lumpus*) were exposed to CR particles (2-4  $\mu\text{m}$ ) in seawater for 7 days, followed by a 14-day depuration period. Blood samples were collected from the fish, together with the stomach and gut for visual detection of CR in the fish intestines. A comprehensive non-target screening analysis of organic chemical content in the blood was conducted using HRGC/HRMS (ThermoFisher, Orbitrap). In addition to the screening, specific focus was given to quantification of *N*-(1,3-dimethylbutyl)-*N'*-phenyl-p-phenylenediamine (6PPD) and its degradation product 6PPD-quinone, known toxicants. Tissue samples were also analyzed for metals by ICP-MS. The exposed lumpfish were found to readily ingest CR alongside food under laboratory conditions. The quantity of CR in intestine samples increased during the exposure period, reaching a maximum level directly after the exposure period ended (day 8). A measurable decrease of CR particles was observed throughout the depuration period, although some individuals still contained CR at the end of the depuration period (day 21). The organic chemicals 6PPD and 6PPD-quinone, as well as other CR-related chemicals, were detected in the blood both on day 7 and day 21. No increased in concentration over time was observed for any of the 10 metals were detected in blood of exposed lumpfish. The study confirms that lumpfish actively ingest CR, causing the transfer of CR-related chemicals to the blood.

**Keywords:** Tire wear rubber, crumb rubber, ingestion, marine

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