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Abstract: In the dredging industry, it is advantageous to have advanced knowledge of the expected particle size distribution (PSD) of material that has been subject to dredging processes. During dredging, the removal and transportation of material result in it undergoing significant physical changes. This paper first considers geotechnical, hydraulic and mechanical processes that influence the PSD of a material dredged by cutter suction dredger (CSD), and discusses the attrition during hydraulic transport through pipelines and pumps. When cutting in-situ material, the failure mechanism for intact material varies with material type e.g. for rock cutting the ductility / brittleness of the material is key. During hydraulic transport, particle behaviour and attrition varies primarily according to particle size, from fines undergoing sustained suspension as a dense carrier-fluid to the rolling bed of rock chips or clay balls. To some degree, the attrition follows a decay behaviour (by mass lost) and reduces the solids-effect, and it is generally most prevalent in centrifugal pumps where the destructive forces are greatest. The second part of the paper discusses existing laboratory tests and their ability to simulate processes of attrition. Promising tests fall into three categories: cutterhead scale-models (for simulating material cutting and entrainment into the suction pipe); drum tests (for simulating pipeline attrition); and centrifugal pipeline-loop tests (for reproducing hydraulic pipeline transport). No single laboratory test provides a comprehensive approach to replicating attrition of material undergoing dredging, though each category of test showed unique advantages and disadvantages when considering practicality, scaling and process similitude.

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