

**Supplementary File 1:** Glossary of the associated terms: chemical stability and thermal stability.

Chemical stability: It refers to the ability of DOM to resist damage to its molecular structure by chemical reagents or chemical processes (such as oxidation, reduction, and hydrolysis), emphasizing the chemical bond strength and reactivity of the molecule itself.

Thermal stability: It refers to the ability of DOM to resist decomposition under elevated temperatures, highlighting its thermal response.