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Microplastics mineralization accelerates soil organic matter decomposition by positive priming effect

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Microplastics (MPs) are considered a novel type of contamination that is abundant in soil due to their recalcitrant nature, potentially affecting the structure and function of the soil. However, the MPs mineralization processes in soil and their priming effects (PE) on original soil organic matter (SOM) decomposition are still poorly understood. Here, we conducted a meta-analysis of 10 published articles to estimate the mineralization rate of MPs in soil and their PE on SOM decomposition. We found that both MPs-derived carbon dioxide (CO₂) and soil-derived CO₂ emissions declined with incubation time. There were differences in mineralization rates among various types, sizes and concentrations of MPs, which affected their PE; however, overall, the input of MPs induced a significant positive PE in soil. In addition, MPs mineralization rate was mainly controlled by soil pH, while PE was primarily regulated by the soil carbon to nitrogen (N) ratio. Furthermore, the concentration of dissolved organic carbon and microbial biomass carbon significantly increased after MPs input, while soil nitrate concentration significantly decreased. These results indicated that MPs input may exert a positive PE by enhancing soil microbial N mineralization. Collectively, our findings provide a comprehensive assessment of MPs mineralization and how it affects soil organic carbon dynamics via stimulating PE, which is important for elucidating SOM turnover under increased MPs pollution.