

# **Phosphorus eutrophication risk in the Rio Doce estuary after the rupture of the Fundão dam**

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## **Introduction**

In November 2015, the rupture of the Fundão dam in Brazil led to the spillage of iron mine tailings into the Doce River basin arriving estuary promoting contamination risk (Gomes et al., 2017; Queiroz et al., 2018). In the soils, iron oxides are widely known for contaminants retention (e.g. metals and phosphorous). However, in the estuarine soil, the iron reduction process is favorable which may release these contaminants. This study aimed to evaluate phosphorus content in the soils of the Doce River estuary after Mariana's tragedy.

## **Materials and Methods**

Soil samples were collected in the Doce River estuary (Espírito Santo state, SE Brazil), 7 days after the arrival of the tailings. A sampler for flooded soils was used to collect soil samples in PVC tubes. During the sampling, the Eh values were determined using a platinum electrode, where the values were adjusted for the calomel reference electrode potential (+244 mV); the pH readings were obtained with a calibrated glass electrode (previous calibrated with pH = 4.0 and 7.0 standard solutions). The total iron and phosphorus contents of the soils and tailings were determined after microwave-assisted triacid digestion (HCl + HNO<sub>3</sub> + HF; USEPA, 1996).

## Results and Discussion

The tailings deposited and soils in the estuary are characterized by redox conditions ranging from anoxic to sub-oxic and a circumneutral pH. The tailings were characterized by total contents of Fe (mean Fe content,  $45,200 \pm 2850 \text{ mg kg}^{-1}$ ) and P (means  $566 \pm 92 \text{ mg kg}^{-1}$ ). In the soils the Fe contents ranging from  $46000 \pm 18500 \text{ mg kg}^{-1}$  at 0-3 cm to  $28300 \pm 22100 \text{ mg kg}^{-1}$  at 15-30 cm, whereas P contents ranging from  $422 \pm 207 \text{ mg kg}^{-1}$  at 0-3 cm to  $32 \pm 6 \text{ mg kg}^{-1}$  at 15-30 cm. Besides a positive correlation between Fe and P ( $r= 0.951$ ;  $n= 15$ ) indicates the P associated to Fe-oxides. Over estuarine conditions (i.e., anoxic) the Fe-oxides may be solubilized through iron reduction process releasing making the P bioavailable. Thus, large P quantities released may lead to eutrophication risk in the Rio Doce estuary (Ding et al., 2016; Kraal et al., 2015).

## Conclusions (70 até 100 palavras)

The Samarco mine disaster caused deposition of millions of tons of Fe-enriched and large P contents. The Fe-oxides deposited in the estuarine wetland soils are closely associated with P contents due to their capacity to P retention. However, estuarine soils conditions possibly leading Fe solubilization and to eutrophication risk by P quantities.

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