



ASSESSING THE BIOCHAR EFFECTS ON NUTRIENTS OF NYABUGOGO WETLAND IRRIGATION WATER AND SOIL

FERTILITY

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ABSTRACT

Biochar exhibits high biodegradability, high contents of total organic carbon and benzene ring structure with different functional groups as well as optimal concentrations of microelements, biochar is the solid carbonaceous product obtained when plant and/or animal biomass is subjected to pyrolysis and it can stabilise heavy metals in contaminated media (Ding *et al.*; 2016). Also, biochar elevates pH by adding alkalinity for soil fertility. More people used wetland water for irrigating the vegetables, legumes and crops. There the amount of nutrients and heavy metals varies depending on region and other factors. According to the previous research, Nyabugogo wetland possesses nutrients but the amount is unbalanced and sometimes insufficient for plant growth. During this research, the amount of nutrients was measured for nitrate, nitrite, ammonium and phosphate and found to be below the standard values of irrigation water set by Rwanda Standards. This is because of metals which makes nutrients unavailable to plants. Hence, biochar produced at temperature between 300°C and 600°C commercially available, was used as an alternative way of providing the nutrients by increasing phosphate and varying nitrogen form concentrations of the irrigating water of Nyabugogo wetland. Although, biochar adsorbent plays two great roles such as removing pollutants and adding nutrients to plants, it can strengthen soil minerals availability (Ding *et al.*; 2016) by exchangeable metal ions and metals attracted to biochar. As such, the effect of biochar on pH, TDS and conductivity has been observed. The experiment was performed by using column glasses at room temperature and involved measuring the level of nitrate, nitrite, ammonium, phosphate, conductivity, TDS and pH of irrigating water before and after running column chromatography. By using UV VIS Spectrophotometer, the results showed that nitrate and nitrite amount decreased with increase in ammonium concentration. Phosphate amount suddenly increased. pH, conductivity and TDS were also increased as time moved.

INTRODUCTION

Nyabugogo wetland holds water from different parts of Kigali city and hence composed by greatly metals which makes nutrients unavailable to plants. Biochars adsorbent play two great roles, removing pollutants and adding nutrients to plants and it can play those role at the same time. As biochar adsorbent is very cheap compared to fertilizers, the ideas came to rise to find a way of using it to provide nutrients to plants through irrigation water, in this paper, the role of biochar as cost effective and available are being used in ion exchange, precipitation and complexation due to its physicochemical properties. The different functional groups such as acidic and basic groups make various reactions to happen as well as improve soil quality, reduce mineral compounds and organic pollutants in the environment (Pituello *et al.*; 2014).

METHODOLOGY



RESULTS AND DISCUSSION

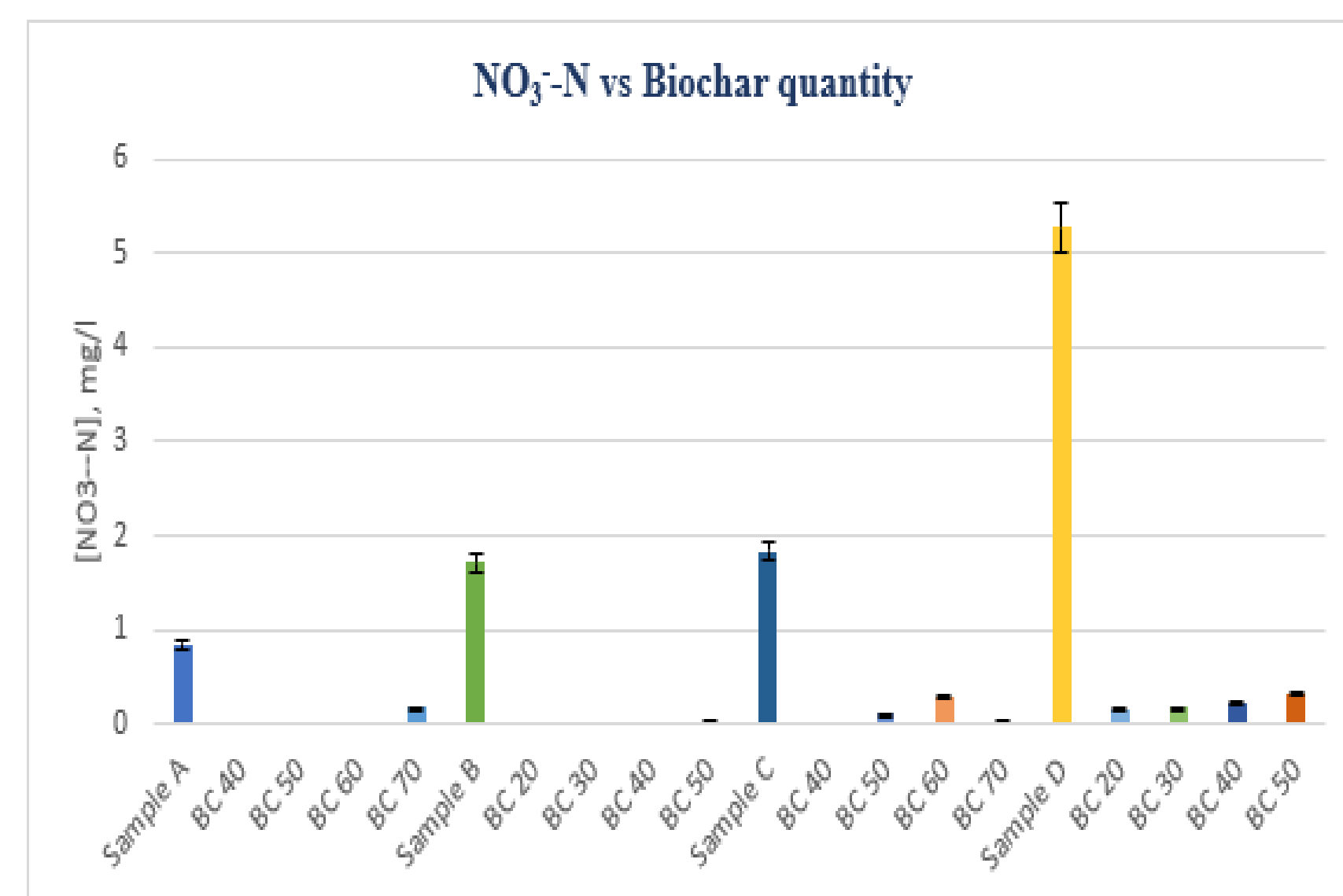


Figure 8. Nitrate variation with biochar quantity with (error values at 5%)

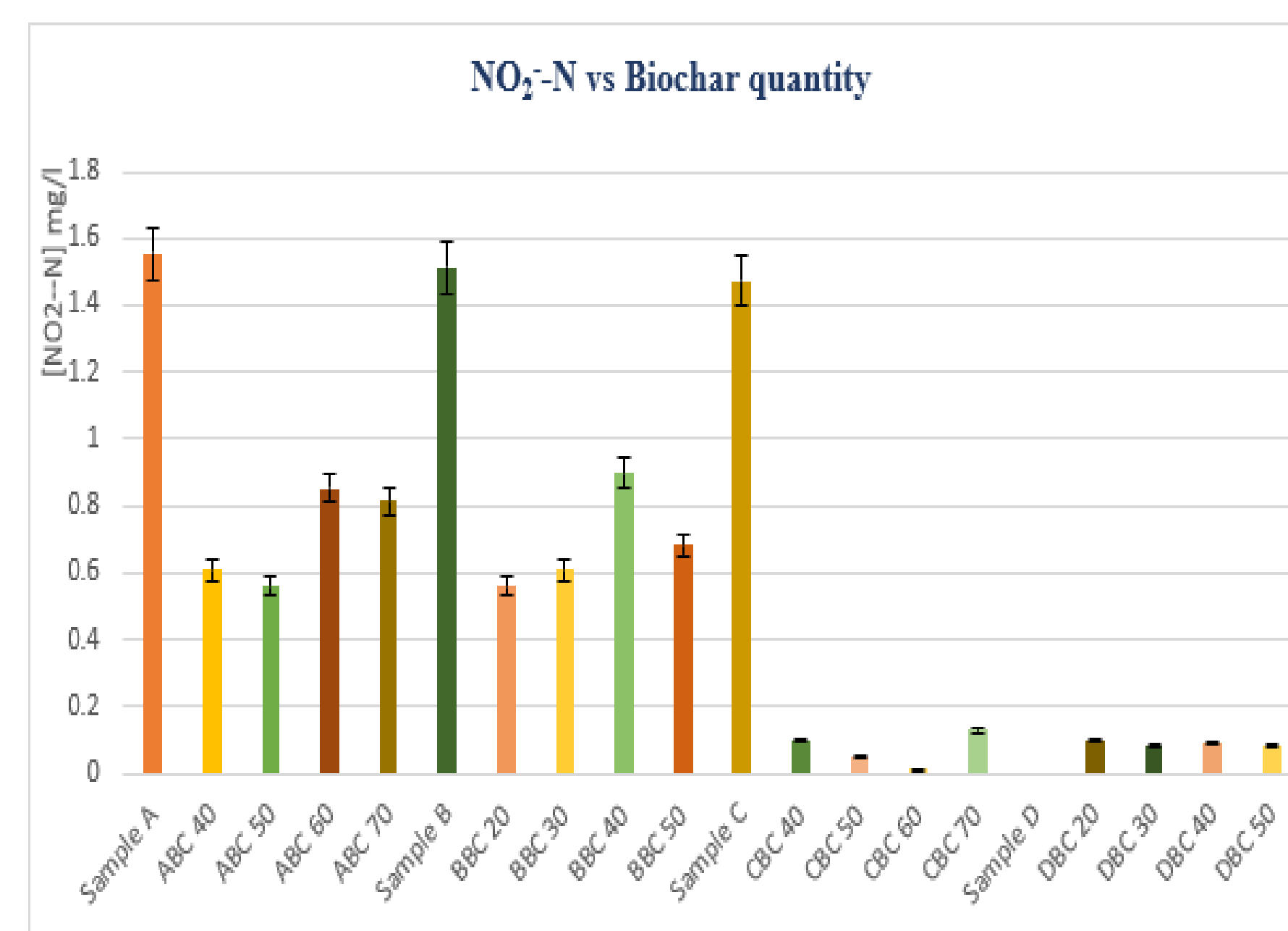


Figure 9. Nitrite variation with biochar quantity (error values at 5%)

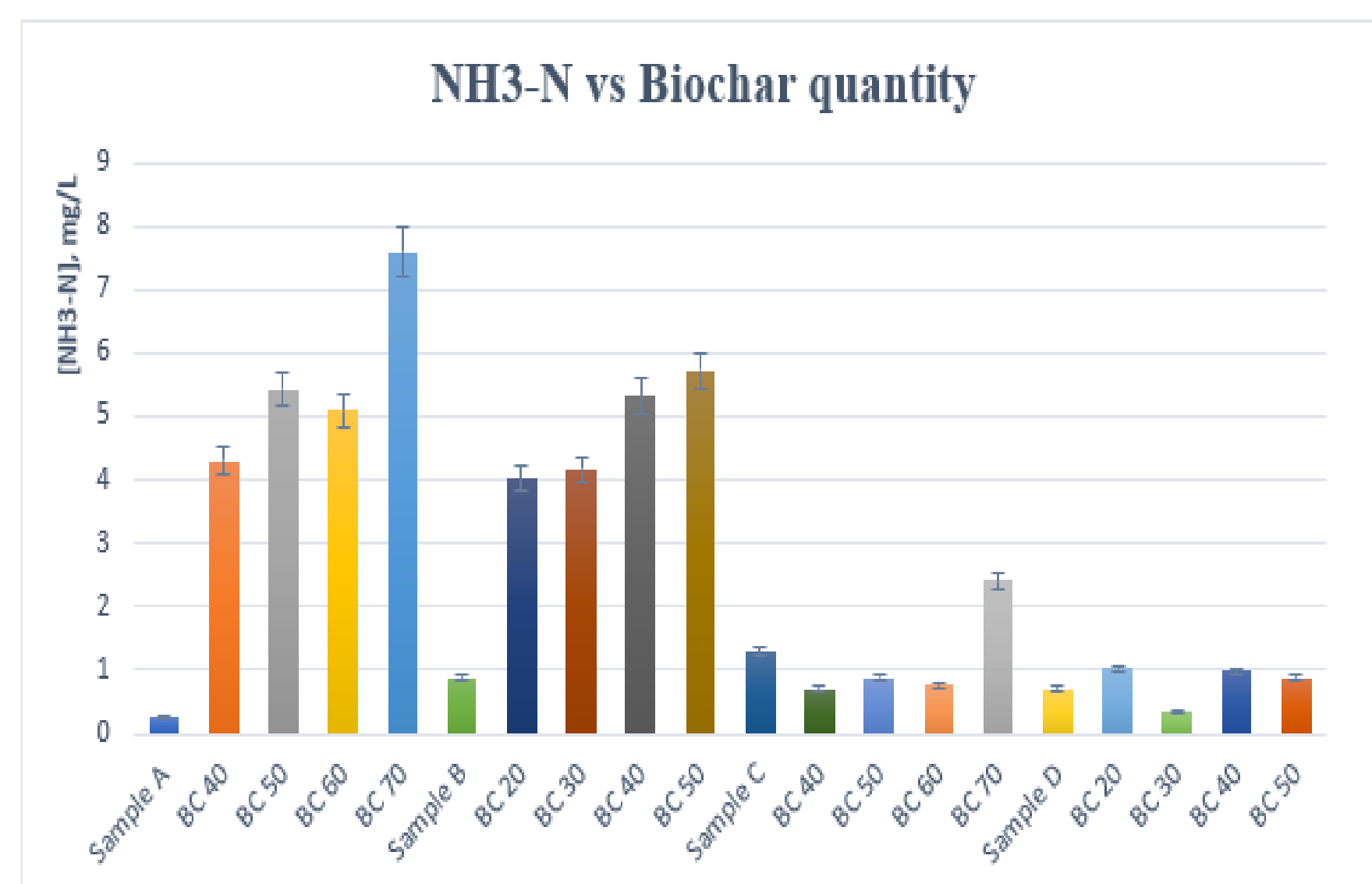


Figure 10. Ammonium variation with biochar quantity (error values at 5%)

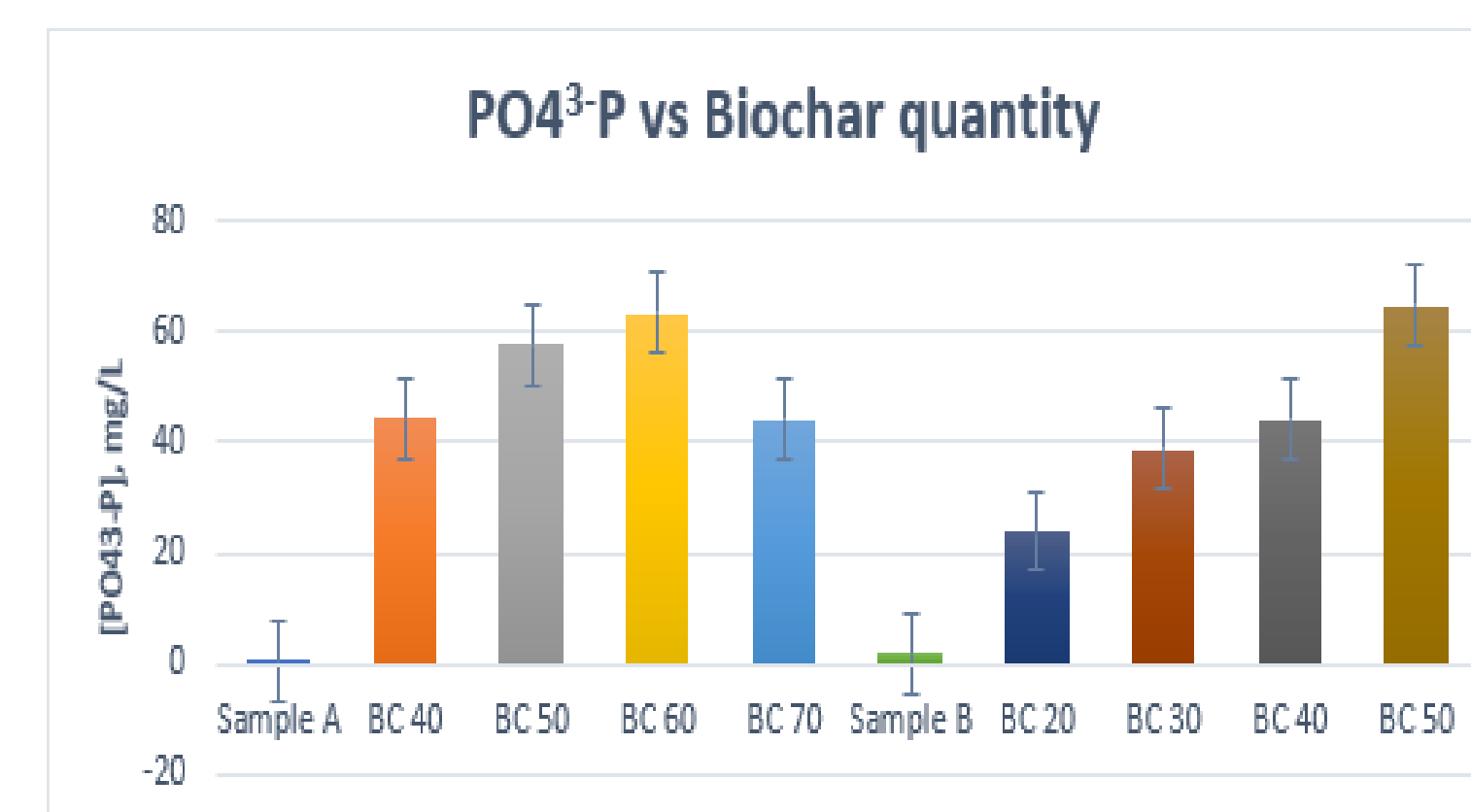
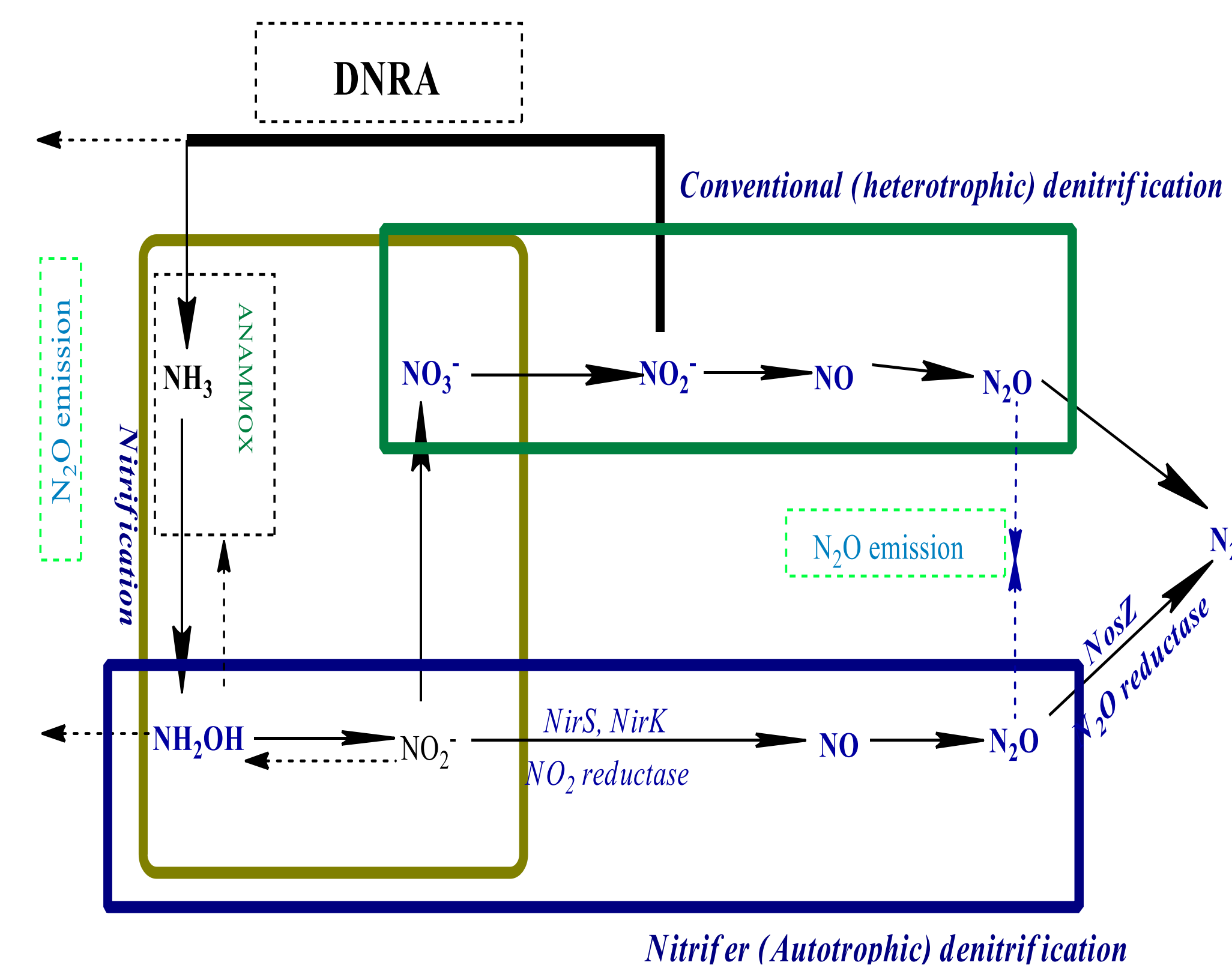


Figure 13. Phosphate variation in sample A and B with biochar quantity (error values at 5%)

Why do nitrate and nitrite values decreased and increased for ammonium?



Scheme 1. Nitrogen cycle by combining nitrification and DNRA (Morley *et al.*, 2012)

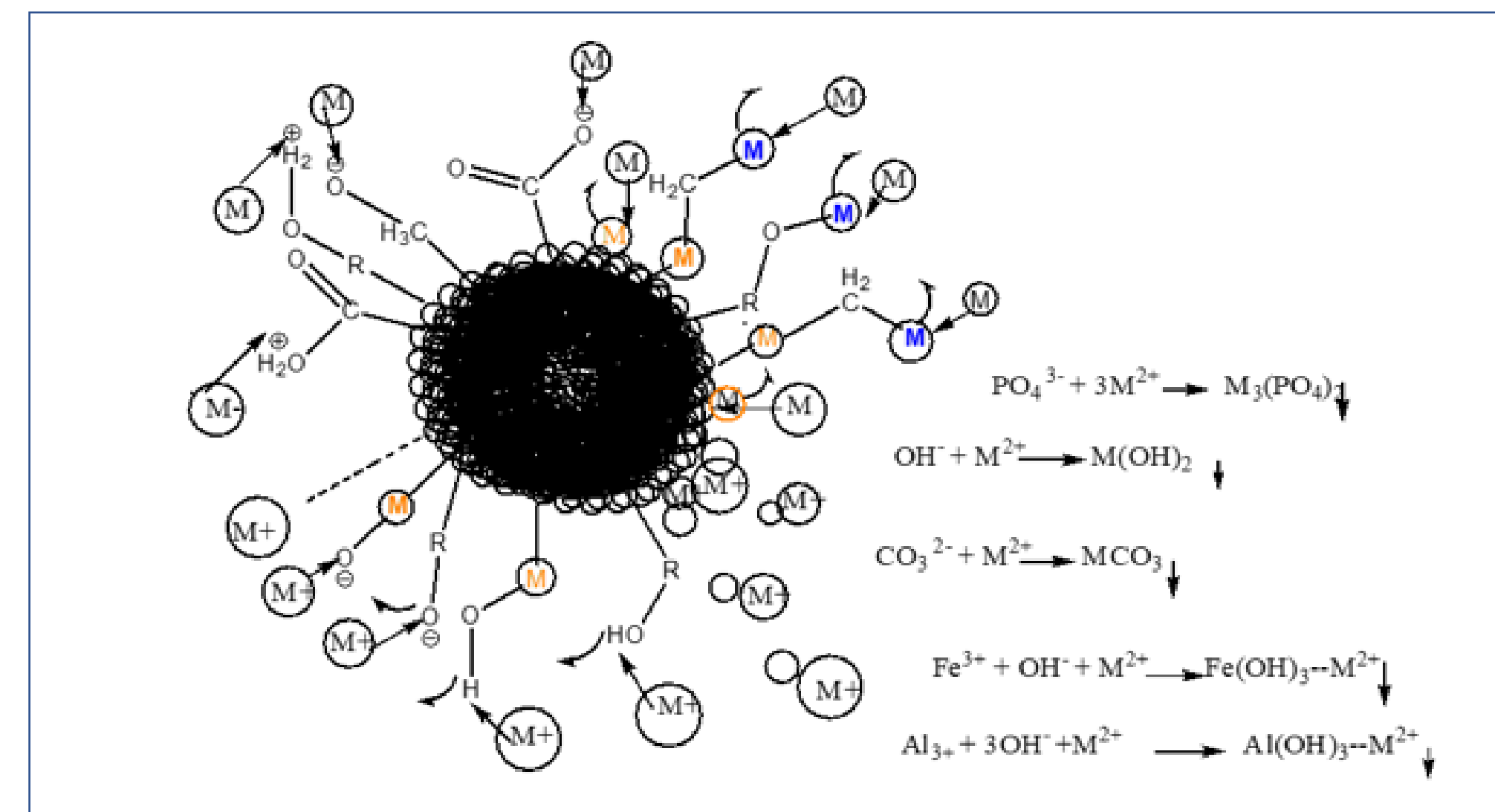
Conclusion

Biochar increases or decreases NO_3^- -N, NO_2^- -N and NH_4^+ -N concentration depending on nature of water, through DNRA

➤ Biochar provides PO_4^{3-} -P to water

➤ Biochar increases pH, TDS and Conductivity values

Therefore, Biochar can be used to provide nutrients to plants through irrigation water.



Biochar contributes more economically available and furnish other environmental benefits such as carbon sequestration and soil health improvement when appropriately applied.

Biochar plays the role of adsorption and ion exchange, it can increase alkalinity and decrease bulk density, where its amendment might be implemented in polluted cropland and secure safe food production

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Pituello, C., Francioso, O., Simonetti, G., Pisi, A., Torreggiani, A., & Berti, A. (2014). *Characterization of chemical-physical, structural and morphological properties of biochars from biowastes produced at different temperatures*. (April). <https://doi.org/10.1007/s11368-014-0964-7>

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Thank you!!