A NEW DIRECT COLORIMETRIC METHOD FOR THE DETERMINATION OF NITRATE IN POTABLE WATERS

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ABSTRACT

The quantification of nitrate is important for evaluation of water quality for agriculture, industrial and biological pollution. Nitrogen, which is a naturally occurring element, can be present in different forms. Nitrate is one of the forms of nitrogen. Nitrate content in water is also important as a nutrient for plants, and in some cases it has been identified as the growth-limiting nutrient.

Authorities have regulated a limit for nitrate in potable water. European community directive 80/778 EEC also has stated a maximum admissible concentration (amount) (MAC) of 50 mg dm^{-3} of NO_3. This directive also gives a guide level of 25-mg dm^{-3} nitrates. U.S. environmental protection agency and World Health Organization (WHO) also has laid down guideline values for nitrate, which is 45-mg dm^{-3} nitrates (10 mg dm^{-3} NO_3-N). The WHO guideline value for water intended for bottle fed infants is 10-mg dm^{-3} nitrates.

There are several methods for determination of nitrate in water. Some are direct methods of determining nitrate and the others are indirect methods. Most of these direct and indirect methods are colorimetric methods. Almost all of the indirect methods involve reduction of nitrate to nitrite using different reducing agents, and then nitrite is detected colorimetrically. Sometimes nitrate is reduced to ammonia and the ammonia is measured or nitrate is reduced to nitric oxide (NO) in acid medium and the resultant NO is reacted with ozone and the chemiluminescence's produced is measured.

This investigation involves colorimetric determination of nitrate in potable water using phenol and its derivative resorcinol dissolved in sulphuric acid. The reference method specified for NO_3-N in Sri Lanka standards for potable water also uses phenol disulphonic acid, which is being prepared using phenol and sulphuric acid. This known reference method has some failures and most of these failures have been overcome by the suggested method. The suggested method of determination of nitrate is a direct colorimetric method. The coloured complex is formed due to the reaction between NO_3-N and the colour reagent. The colour reagent has been prepared using phenol, resorcinol and sulphuric acid. The maximum colour development of formed aromatic nitro compound occurs around pH 13. This yellow coloured complex absorbs in the visible region. This absorbance value given by the resultant yellow coloured aromatic nitro compound can be used for the quantitative determination of NO_3-N in water by comparison with a calibration graph drawn using standard NO_3-N solutions prepared using potassium nitrate.

Some of the failures of reference method have been overcome by the suggested method. But there are some disadvantages too. The main disadvantage is that the suggested method cannot be applied for the determination of NO_3-N in raw wastewater, because of its coloured, turbid nature. The presence of high amounts of suspended solids also a major draw back in applying this suggested method for NO_3-N determination in wastewater.