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Evaluation of total phenol pollution in water of San Martin Canal from Santiago del Estero, Argentina☆

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ABSTRACT

Santiago del Estero is a province located in northwestern Argentina. The Dulce River is used for irrigation through a vast network of channels and ditches, including the San Martin Canal (SMC), which crosses the capital city of Santiago del Estero. This canal's water is used for drinking, as well as recreational use for the general population. However, this river has been seriously polluted for several decades.

The present study focuses on the identification and the quantification of the water pollution levels of total phenols in the SMC according to the seasonal periods. Water samples from various areas of the canal in different months of the year, extending from December to September, were collected for analysis. Additionally, the concentration of total dissolved solids (TDS), chlorides, sulphates, nitrites and organic matter, as well as water hardness and alkalinity, were analysed in order to conduct a more complete study of the contamination of this area. The results showed a worrying total phenol concentration that exceeded the limit set by Argentine legislation for drinking water, as well as water for recreational use (5 μg/L). The total phenol (TP) concentration was directly determined by a molecular absorption spectroscopy method based on a new flow injection analysis system (FIA). Under the selected experimental conditions, the detection and quantification limits were 0.0490 and 0.1633 μg/mL, respectively. The developed method provides a number of improvements related to the speed of analysis, the restricted consumption of the reagents and sample volumes and the unnecessary sample treatment that contribute to environmentally friendly analytical chemistry. The results showed that TP make a significant contribution in the SMC pollution, especially during the months of April (400 ± 110 μg/L) and September (240 ± 20 μg/L). A high sulphate concentration that was higher than the limit allowed by the legislation was also found.

1. Introduction

The Dulce River, the most important river in the Argentine province of Santiago del Estero, begins in the Tucumán Province. Derivation channels and ditches, including the San Martin Canal (SMC), have been constructed to enable integral and permanent use of the waters of the Rio Dulce, to overcome the limitations of seasonal irrigation and the salinization of the soils and to add thousands of hectares to the agriculturally productive area of the province. The SMC crosses the city of Santiago del Estero (capital of the province of Santiago del Estero) from north to south, passing through the urban agglomerate that forms the city of Santiago del Estero. Consequently, the canal receives a high wastewater load from these densely populated zones that affects the water quality and could be associated with a wide range of diseases affecting the inhabitants of the surrounding areas.

The San Martin Canal passes through urbanized areas and is widely used for consumption. In certain cases, in hot weather, the water of the SMC is also used for recreational activities. To the best of our knowledge, there have been no studies that provide data and information related to the quality and usability of the water of the canal. There are no warnings for the residents regarding the use of this water, particularly for children who use the canal water for swimming.

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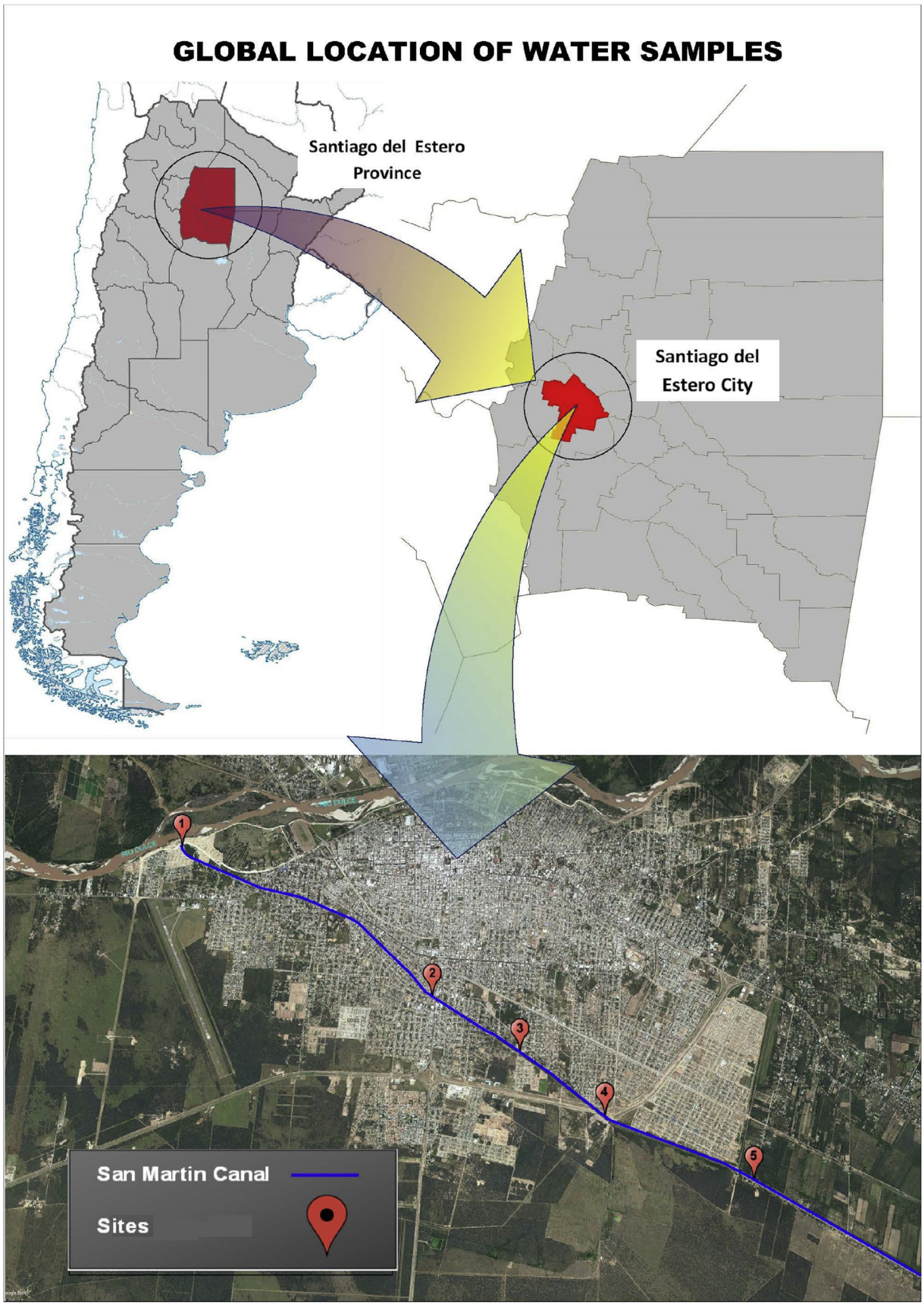

Fig. 1. Geographic location of San Martin Canal in the city of Santiago del Estero belonging to the Santiago del Estero Province (Argentine). Geographic distribution of water sites in the San Martin Canal.