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Characterisation of Tomato Waste-Water

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ABSTRACT: *The aim of this research was to characterize tomato (Lycopersicon esculentum) waste water in order to assess its possible use. The tomato waste was produced by blending the fresh tomato fruits (blending process enhanced by adding appropriate volume of water) and the fresh tomato paste separated from the waste by filtration; filtrate labeled tomato waste. The waste water was characterized for its ability to remove rust from rusty metals (nails and keys), and analysis by GC-MS. The tomato waste water was found to contain lycopene, beta carotene, g carotene, 3-phenyl-1,4-benzopyrone, Lycopene, beta carotene, g-carotene, phytoene, folate, methanol; Lycopene and phytoene are good dietary ingredients known to reduce the risk of chronic diseases, such as cancer and cardiovascular disease. It also displayed the capability of removing rust from rusty nails and keys.*

Keywords: *tomato waste, GC-MS, rust removal, Lycopersicon esculentum.*

I. INTRODUCTION

Tomato (*Lycopersicon esculentum*) is one of the major vegetables wildly consumed around the world. It is also widely used by the food industries as a raw material for the production of derivate products such as purees and ketchup [1]. It is also the most common vegetable in the Mediterranean diet, a diet known to be beneficial for health, especially with regard to the development of chronic degeneration disease, and the health benefits of tomato are attributed to the abundant antioxidant component present in tomato [2].

However, processing tomato is always accompanied by production of waste water which seems to have no use and often constitute environmental nuisance. It is interesting to note that no work has been done on waste except on the solid tomato waste. The capability of waste tomato as an adsorbent was studied by [3]. In another development, Nour [4] studied the pH, EC, Cl, P, and trace metals of tomato waste water. In an attempt to manage water resource, Irénikatché [5] studied the benefits of re-using tomato waste water to irrigate farmlands for planting.

The aim of this research was to characterize tomato waste water in order to assess its possible use. The waste water was characterized for its ability to remove rust from rusty nails, and also analyzed by GC-MS.

II. Materials And Method

Tomato fruits (sample), dichloromethane, gas chromatography mass spectrometer (GC-MS); with model identification of QP 2010 (shimadzu), equipped with a split/splitless injector.

III. SAMPLE COLLECTION/PREPARATION

The tomato used in this research was bought from Opolo Market in Yenegoa, Bayelsa State, Nigeria. The tomato was washed with distilled water and sliced to smaller sizes, for easy blending. The tomato pieces were ground and the resulting fresh paste and the waste water (filtrate) were separated by filtration. Liquid-liquid extraction was carried out on the filtrate and the resulting organic extract was analyzed; Liquid-liquid extraction process was carried out using dichloromethane.

IV. LIQUID-LIQUID EXTRACTION WITH N-HEXANE AND DICHLOROMETHANE

Liquid-liquid extraction of the aqueous solution of the tomato waste water (20 mL) was carried out using 20 mL of dichloromethane. This was repeated and the organic phases collected. The total volume (40 mL) of the organic phases was pre-concentrated to 5 mL and this was analyzed by using GC-MS.

V. GC-MS ANALYSIS OF TOMATO EXTRACTS

The extracts were analysed by using a gas chromatography quadrupole mass spectrometry. A capillary column HP-FFAP (30 m × 0.25 mm i.d, 0.25 µm film thickness, Agilent technologies) was used for the separation. The temperature of the injector was set at 230^{o}C, and the oven temperature was programmed as follows: held at 50^{o}C for 5 min and then programmed to rise from 50^{o}C to 200^{o}C at 3^{o}C/min and then held at 200^{o}C for 10 min and then programmed to go from 200^{o}C to 240^{o}C, at 10^{o}C/min. Finally, it was held at 240^{o}C for 20 min.

The carrier gas was helium at 49.5kpa, which corresponds to a linear speed of 15.5 cm/s. The detector was operated in the electron –impact mode (70eV), and mass spectra were acquired by scanning over the mas/charge (m/z) range of 45-500.

VI. RUST REMOVAL WITH TOMATO WASTE-WATER

2 L of tomato waste water was added to some pieces of rusty nails in a pot and boiled for 20 min. The nails were removed from the pot and a piece of metal was used to scrape the nail and the result was recorded. 2 L of water was added to some pieces of rusty nails in a pot and boiled for 20 min. The nails were removed from the pot and a piece of metal was used to scrape the nail and the result was recorded.

RESULTS AND DISCUSSION

GC-MS ANALYSIS

The GC-MS results of the dichloromethane-extract of the tomato waste water are shown in Figure 1 and Table 1; Figure 1 shows the chromatogram of the separated components, and Table 1 shows the concentration in ppb of the separated components.

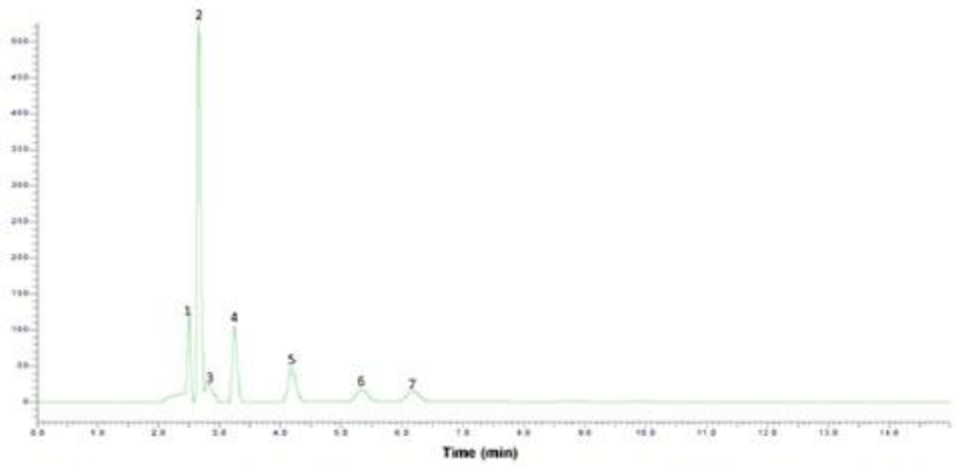

Figure 1. Chromatogram of tomato waste water in dichloromethane. 1 = 3-phenyl-1,4 benzopyrone, 2= lycopene, 3 = beta carotene, 4 = sigma carotene, 5 = phytoene, 6 = folate, 7 = methanol

Table 1. Concentration of the different components

Component	Concentration in ppb
3-phenyl-1,4-benzopyrone	42.33
Lycopene	182.31
Beta carotene	6.27
g-carotene	42.86
Phytoene	10.27
Folate	5.29
Methanol	3.84

Lycopene is a fat soluble carotenoid with 11 conjugated double bonds in the molecule, and it is a precursor of the carotene with a well-known antioxidant activity [6].

Carotenoids are often considered to be plant pigments, and they occur universally in the chloroplasts of all higher plants and algae. They are most obvious, however, when they occur in non-photosynthetic tissues, where they are responsible for the yellow, orange, and red colours of many fruits, flowers, and **roots** [7, 8]. Lycopene, phytoene and phytofluene are good dietary ingredients known to reduce the risk of chronic diseases, such as cancer and cardiovascular disease [9, 10].

VII. Rust Removal Test

Figures 2, 3, and 4, show the results of rust-removal tests; Figure 2 shows the rusty nails, Figure 3 shows the rust nails boiled in tomato waste water; rust was removed, Figure 4 shows the rust nails boiled in water (controlled experiments); rust was not removed. Figures 5 and 6 show the results of application of tomato waste water on keys; 5a and 6a are the same keys and they respectively show key before boiling and after boiling in waste water. 5b and 6b are the same keys but they respectively show key before boiling and after boiling in waste water. The results show that much of the rusts was removed from the keys when they were boiled and scraped with a piece of iron. A control experiment of boiling the rusty keys with ordinary was set and the rust was not removed.

Figure 2. Rusty nails

Figure 3. Rusty nails boiled with tomato wastewater

Figure 4. Rust nails boiled with water

Figure 5. Rusty keys boiled with water; compare 5-a and 6-a; 5-b and 6b

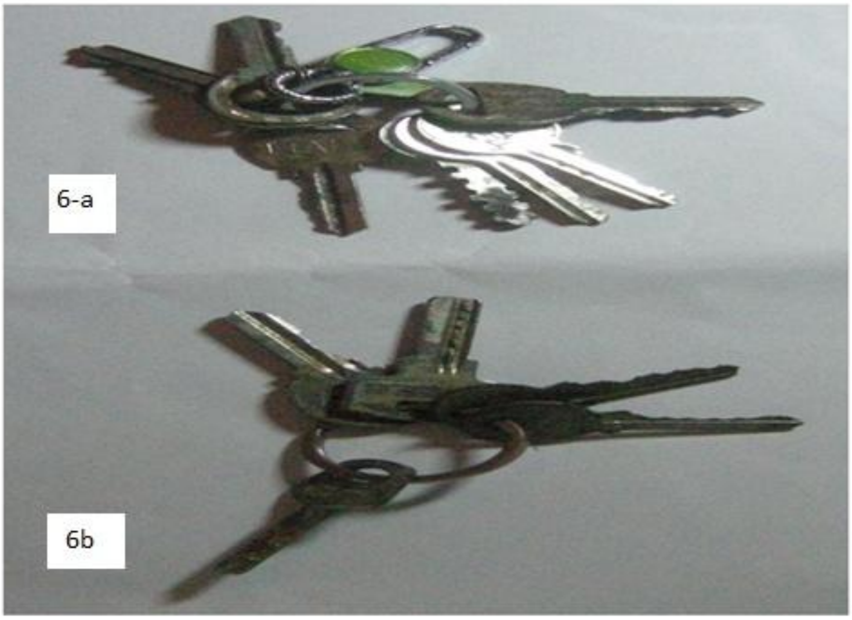

Figure 6. Rusty keys boiled with tomato waste water. Compare 5-a and 6-a; 5-b and 6b

VIII. CONCLUSION

Tomato waste water, that seemly have no good qualities, was found to contain 3-phenyl-1,4, benzophyrone, β-carotene, g-carotene, folate, methanol, phytoene lycopene; lycopene and phytoene. Some of the constituent compounds are known to be good dietary ingredients that can reduce the risk of chronic diseases, such as cancer and cardiovascular disease. Interestingly, it displayed the capability of removing rust from rusty nails and keys.

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