

## INFLUÊNCIA DA UTILIZAÇÃO DE ÁGUA RESIDUÁRIA TRATADA NAS CARACTERÍSTICAS MICROBIOLÓGICAS DA CEBOLA.

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### 1 RESUMO

Esta pesquisa teve como objetivo avaliar a viabilidade do reúso de água residuária proveniente de uma estação de tratamento de água na agricultura irrigada da cultura da cebola, visando a otimização desse recurso. A presente pesquisa realizou-se em ambiente protegido do Departamento de Engenharia Agrônômica da Universidade Federal de Sergipe no período de 28 de maio a 23 de setembro de 2024. O experimento foi conduzido em delineamento experimental de blocos inteiramente casualizados (DIC), composto por 3 blocos, contendo 3 tratamentos (T1: irrigado 100% com água potável da Companhia de Saneamento de Sergipe – DESO; T2: irrigado com 50% de água potável da DESO e 50% com efluente; T3: irrigado 100% com efluente), 5 repetições de cada tratamento por bloco, totalizando 45 vasos. As variáveis microbiológicas da cultura analisada foram Coliformes termotolerantes, *Escherichia coli* e *Salmonella*, foram analisadas pelo Departamento de Tecnologia em Alimentos da UFS. As amostras submetidas aos três tratamentos atenderam aos limites estabelecidos segundo a Instrução Normativa nº 161 de 1º de julho de 2022, do ministério da Agricultura e a Resolução – RDC nº 12 de 2001 ANVISA. Torna-se recomendável o reúso de água inicialmente tratada proveniente de estação de tratamento em até 100% da irrigação na cultura da cebola.

**Palavras-chave:** reúso de água, irrigação, Coliformes termotolerantes, *Escherichia coli*.

**FACCIOLI, G. G.; SANTANA, F. S.; RAMOS, C. A.; CARVALHO, T. S.; GOMES FILHO, R. R.; SILVA, L. F. C.**

**INFLUENCE OF THE USE OF TREATED WASTEWATER ON THE MICROBIOLOGICAL CHARACTERISTIC OF ONION.**

## **2 ABSTRACT**

This research aimed to evaluate the feasibility of reusing wastewater from a water treatment plant in irrigated agriculture for onion cultivation, with the objective of optimizing this resource. The study was conducted in a controlled environment at the Department of Agronomic Engineering of the Federal University of Sergipe from May 28 to September 23, 2024. The experiment followed a completely randomized block design (DIC), consisting of 3 blocks, each containing 3 treatments (T1: irrigated 100% with drinkable water from the Sergipe Sanitation Company – DESO; T2: irrigated with 50% potable water from DESO and 50% with effluent; T3: irrigated 100% with effluent), with 5 repetitions per block, for a total of 45 pots. The microbiological variables of the analyzed crops were thermotolerant coliforms, *Escherichia coli*, and Salmonella, which were analyzed by the Department of Food Technology at UFS. The samples subjected to the three treatments met the limits established according to Normative Instruction No. 161 of July 1, 2022, by the Ministry of Agriculture and Resolution – RDC No. 12 of 2001 by ANVISA. The reuse of initially treated water from treatment plants for up to 100% irrigation in onion cultivation is therefore recommended.

**Keywords:** water reuse, irrigation, thermotolerant Coliforms, *Escherichia coli*.

## **3 INTRODUCTION**

Over the past 50 years, with the expansion of the urban population and the growth of industrial and technological development, the few available sources of fresh water on the planet have been compromised or at serious risk. The current panorama clearly points to many countries that do not have enough water to meet demand, and as a result, aquifers are frequently depleted due to excessive extraction. According to the United Nations (UNITED NATIONS BRAZIL, 2021), fresh water consumption has increased 6-fold in the last century and continues to increase at a rate of 1% per year as a result of population growth, economic development and changes in consumption patterns.

According to the United Nations Environment Programme (UNEP, 2004),

water scarcity is accompanied by a deterioration in water quality due to pollution and environmental degradation.

The outlook for the coming years regarding water and food is neither favorable nor optimistic. Population and economic growth tend to lead to an increase in water consumption in all scenarios (UNEP, 2004).

Therefore, as the demand for water continues to increase, the return of wastewater and its reuse has become a fundamental component in the planning, development and use of water resources in all regions, whether arid or semiarid. The use of wastewater for nonpotable purposes, such as agriculture, has potential as a replacement for the use of treated and potable water (Braga; Lima, 2014).

Microbiological analysis of the water used for irrigation is extremely important for ensuring the quality of

agricultural products in terms of public health and the environment. The analyses must be carried out in accordance with the parameters and limits established by CONAMA Resolution No. 357 of March 17, 2005, and by CONAMA Resolution No. 430/11 of the Ministry of the Environment. The resolutions ensure that the water used for irrigation does not contain pathogens or harmful substances, reducing the risk of crop contamination and protecting consumers.

The present study aimed to verify the influence of the use of treated wastewater on the microbiological characteristics of the Vale Ouro IPA-11 onion.

#### 4 MATERIALS AND METHODS

The experiment was conducted in a protected environment located in the Department of Agricultural Engineering of the Federal University of Sergipe in the city of São Cristóvão, Sergipe. The completely randomized design (CRD) method was used, with onion crops and five replicates, for a total of 45 pots. The treatments were as follows: T1, 100% irrigated with drinking water from the Sergipe Sanitation Company - DESO; T2, 50% irrigated with drinking water from the Sergipe Sanitation Company - DESO and 50% irrigated with effluent; and T3, 100% irrigated with effluent.

Planting was carried out in soil already used in previous research with the same treatment procedures, aiming to analyze the ideal time to perform a crop rotation, as it was observed in other experiments that the use of effluent alters the characteristics of the soil, making it more sodic, which influences the absorption of nutrients for the plant. The soil used was an Argisol collected at the Rural Campus of the Federal University of Sergipe in 2021, where it was sieved and homogenized and

inserted into 25 L plastic pots, which were separated into blocks and properly positioned on pallets in the center of the protected environment, 0.15 m high and measuring  $1.20 \times 1.00$  m. Foundation fertilization was applied to all the treatments on May 28, and the values for each nutrient were 5 g of urea, 11.5 g of simple superphosphate, and 2.6 g of potassium chloride. On June 28, July 17 and August 7, split topdressing fertilizer was applied, and the values for the nutrients were 6 g of urea and 6 g of potassium chloride.

In accordance with Santos (2022), who grew onions in a protected environment via external meteorological data, he observed the behavior of onion subjected to different methods of estimating irrigation depths. For this experiment, the FAO Penman–Montteith method was used.

The onion seedlings were transplanted on May 28, 2024. Two different water sources were used for irrigation: drinking water from the Sergipe Sanitation Company (DESO), which was collected daily in a pipe located inside the protected environment, and effluent, which was collected in 20-liter plastic containers with lids and transported to the protected environment weekly. The water demand was calculated daily from the information on relative humidity, maximum and minimum temperatures, and external radiation multiplied by 80%, referring to the protection of the screens in the protected environment. Using the Penman–Montteith equation, the daily ET<sub>0</sub> and cultivation coefficient (K<sub>c</sub>) were obtained. With these data, the daily irrigation depth was calculated.

For microbiological analysis, 250 g of harvested bulbs were placed in plastic bags and sent to the UFS Food Technology Department. The quantities of thermotolerant coliforms and *Escherichia coli* and the presence of *Salmonella* were verified. The American Public Health

Association (APHA) most likely number method was used.

## 5 RESULTS AND DISCUSSION

Table 1 shows the results of the microbiological analyses of the onion bulb. The absence of Salmonella and a quantity of less than 3.0 MPN/g for Thermotolerant

Coliforms and *Escherichia coli* were observed in the bulbs of the three treatments. According to the parameters analyzed to comply with the Maximum Permitted Values, as per Normative Instruction No. 161, of July 1, 2022, of the Ministry of Agriculture and Resolution – RDC No. 12 of 2001 of ANVISA, the results obtained in the analyses of all samples met the established limits.

**Table 1.** Results of microbiological analysis of onion.

Variables	T1	T2	T3	Anvisa (RDC, 161/2022)
Thermotolerant Coliforms	< 3.0	< 3.0	< 3.0	10 <sup>2</sup>
<i>Escherichia coli</i>	< 3.0	< 3.0	< 3.0	10 <sup>2</sup>
Salmonella	Absence	Absence	Absence	Absence

**Source:** Department of Food Technology, UFS.

Carvalho *et al.* (2013), when irrigating sunflowers with wastewater, presented the results of the analyses of thermotolerant coliforms and Salmonella in the dry matter of sunflower, which were compared with the legal standards of the National Health Surveillance Agency for human consumption, and it was observed that they were within the regularity of Brazilian legislation.

Faccioli *et al.* (2017) reported that the reuse of wastewater in the BRS Novaera cowpea crop did not interfere with the microbiological characteristics, in relation to coliforms and the absence of Salmonella, which was found in the analysis on the basis of ANVISA guidelines.

Dantas *et al.* (2018) performed microbiological analyses of okra crops irrigated with domestic effluent and, when highlighting the results regarding thermotolerant coliforms and Salmonella, reported that they are lower than the parameters established by ANVISA. Therefore, the reuse of wastewater for irrigation of this crop is viable.

Souza (2022) used the fertigation of lettuce with domestic sewage treated with orange bagasse biochar and reported that

the cultivated lettuce leaves met the criteria established for human consumption.

Santana (2025) reported that irrigating red cabbage crops with effluent met established limits, confirming that the use of wastewater did not affect the microbiological characteristics of red cabbage.

## 6 CONCLUSIONS

The use of treated wastewater in the irrigation of onion crops did not influence the microbiological characteristics evaluated, as they presented values below 10<sup>2</sup> for thermotolerant coliforms and *Escherichia coli* and were absent for Salmonella, therefore meeting the parameters established by current legislation.

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