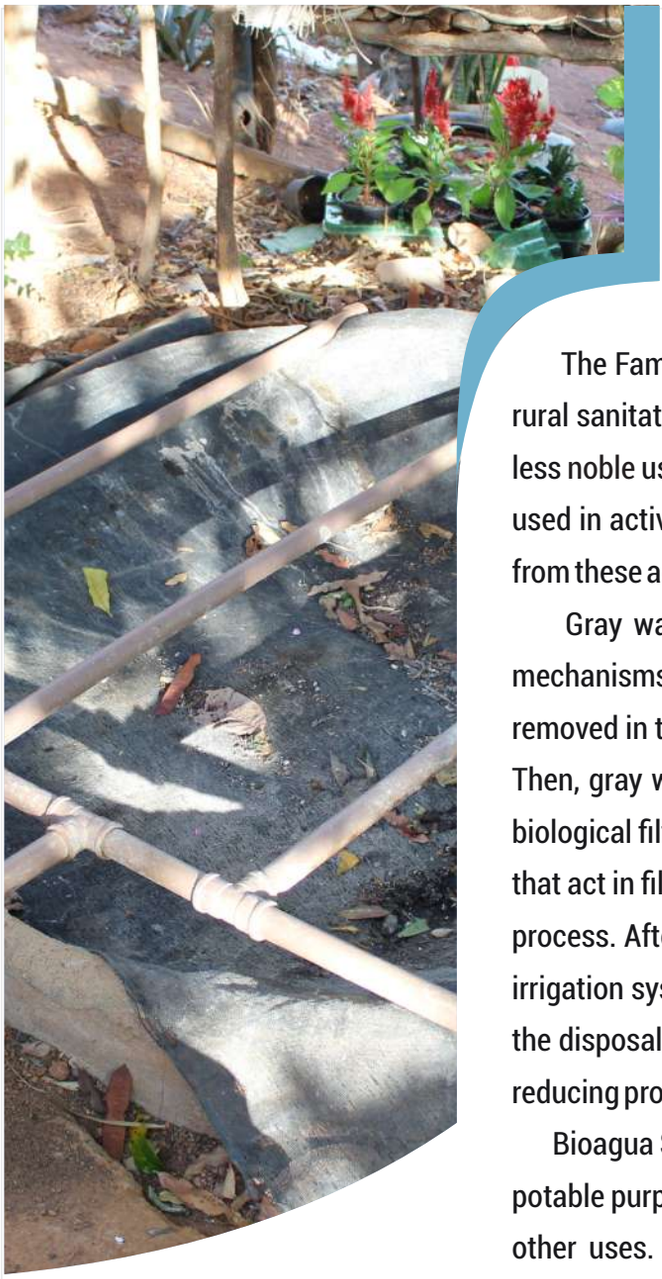
DIGITAL
PORTFOLIO

BIOAGUA

IACOC
Compromisso com o desenvolvimento socioeconômico do Semiárido paraibano
PaqTcPB Fundação Parque Tecnológico da Paraíba
UFCG Universidade Federal de Campina Grande
INSA Instituto Nacional do Semiárido
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E INOVAÇÕES
PÁTRIA AMADA BRASIL GOVERNO FEDERAL
JL FIDA
Investindo nas populações rurais



The Family Biowater System is a social technology for water treatment and rural sanitation that makes it possible to generate water for irrigation and other less noble uses. This system aims to treat and make available the water that was used in activities such as bathing, washing clothes, dishes and pots. The water from these activities is called gray (or grey) water.

Gray water treatment by this kind of technology occurs through filtering mechanisms and by physical and biological processes. The coarse residues are removed in the treatment through a component of the system called the fat box. Then, gray water continues through a hydraulic network that distributes it to a biological filter. There is an action of organisms and microorganisms in this filter that act in filtering compartments, where the water goes through the purification process. After filtering, the treated gray water is stored to be pumped into a drip irrigation system. This social technology is considered a suitable alternative for the disposal of effluents, helping to meet the nutritional requirements of plants, reducing production costs and increasing the biological activity of the soil.

Bioagua System promotes water saving, allowing the user to reuse it for non-potable purposes, such as growing plants, washing sidewalks and floors, among other uses. This is essential in periods of water crisis, even more so in the Brazilian semiarid region, which has a climatic characteristic as an intense water evaporation and average annual precipitation less than 800 mm. The Projects financed by IFAD that involve the installation and implementation of social technologies such as the Bioagua System are quite relevant, as the reuse of treated gray water for agricultural purposes is a viable alternative that increases water availability and helps to overcome scarcity, mitigating the severe impacts of drought.

Bioagua System implementation, in line with the family farmer's experience, allows for a more sustainable and careful management of the land, guarantees food security and the commercialization of production surpluses. Thus, during raining periods, families can store treated gray water, and in critical periods, can irrigate crops, and consequently, maintain family income. In view of this scenario, living with the Semi-arid region allows rural communities to adapt and learn to use natural resources in a more rational way, especially water, the most scarce resource in the region.

Factors that promote or limit the technology adoption

Bioagua System is a complementary action that can ensure a better supply of water at a low cost, based on the rational use of water and adequate destination of effluents, especially in regions where access to water is a limiting factor. In general, this technology is followed by training and contributes to water and food security within the concept of the circular economy. With respect to the limiting factors of the technology, there is the possibility of contamination by pathogenic microorganisms, needed the management of the technology following the good practices of use of Bioagua and the periodic monitoring of the quality of the treated gray water.

Installation cost analysis

Installation costs (value in R$):	**R$ 3,500.00 to R $ 7,500.00**
Maintenance costs (value in R$):	**R$ 0.00 to 600.00**
Technology lifetime (value in years):	**up to 20 years**

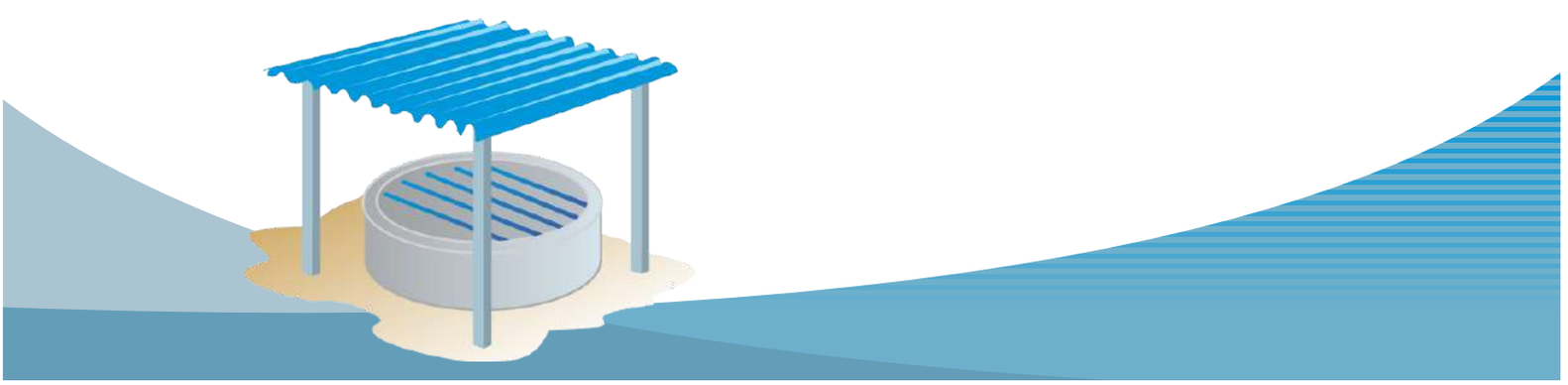
Environmental impacts

According to the National Sanitation Information System (SNIS), the population's attendance to sewage collection corresponds to 53% in Brazil. From this scenario, it is possible to observe a chain of possible negative impacts. In places that lack sanitation, the main problem is related to the fact that untreated sewage is discharged without any criteria. This action generates a domino effect, because with the indiscriminate increase of organic load in the soil, infiltration through the water table can reach the water bodies and increase the nitrogen and phosphorus rates in the water. The excess of these elements cause chemical, physical and biological reactions and can cause the death of aquatic organisms, origin waterborne diseases, among other problems. Although water has an incredible power to recover, the self-cleaning, a large amount of sewage released makes it difficult to treat it so that it becomes potable again.

With the treatment by Bioagua System, it is possible to reduce this indiscriminate discharge of sewage, taking advantage of the organic matter present in the treated gray water to irrigate crops. Some studies show the importance of organic matter and other elements present in reused water and its application in agriculture for improving the physical, biological and chemical conditions of the soil. One of the factors is related to the increase of some chemical elements such as phosphorus and nitrogen, which are a problem for water bodies due to eutrophication, but which would be a solution for some classes of soils in the Brazilian semiarid region, such as the litolic Neossol, as they are elements rarely found in these locations and are important nutrients for the development of crops.

Social impacts on women

In comparison to the reuse in the disposal of gray water, Bioagua System facilitates the work of the farming family, because to make the reuse of disposal they would have to gather the water after each use in the kitchen and washing clothes and store this volume in buckets or compartments, usually, 100 or 200 liters. After all this work, gray waters can be used to irrigate the plants around the houses, even if manually, plant by plant, making the activity even more tiring. In Bioagua System, the waters used are sent through hydraulic pipes to the biological and physical filters, where treatment and subsequent storage takes place in larger and appropriate reservoirs. From this reservoir, water can be pumped into a drip irrigation system, simplifying all work with the reuse of household effluent and also expanding the plant production system, providing more free time for other activities. More income is generated.



CO_2 EMISSION ANALYSIS

For the computation of CO_2 emissions in Bioagua System, chemical analysis of the reused water must be performed, for comparison with fertilizers made with chemical fertilizers. Another possibility is the use of sensors in the places where effluents are released into the Bioagua System to obtain the emissions index.

The reduction in CO_2 emissions related to the Bioagua System must be calculated on a case-by-case basis, taking into account emissions from the discharge of effluents in the absence of this technology. The great highlight of Bioagua System is the saving of water through reuse, reducing expenses with the use of treated water, which can also serve as a basis for calculating reductions in CO_2 emissions.

TOTAL QUANTITY INSTALLED AND NUMBER OF BENEFICIARIES

Installed Quantity (total value): **494**

Number of beneficiaries (total value): **494 families**

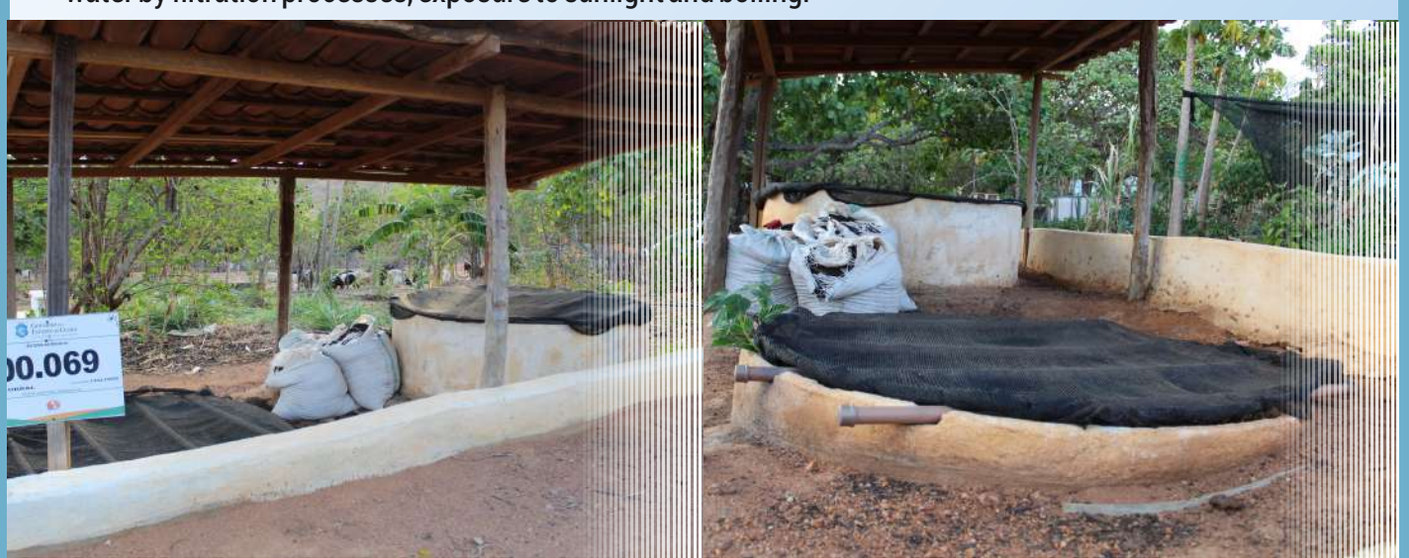
Municipalities (total value): **21 MUNICIPALITIES BENEFITED IN FOUR STATES**

SOCIAL TECHNOLOGY TRL

To assess the technological maturity of Bioagua System, the Technology Readiness Level - TRL was used, which is a methodology that measures this maturity, using a scale with nine levels: each level corresponds to a development phase. Based on this concept, it is possible to assess that the Bioagua System fits into the TRL from 7 to 8, because TRL 7 consists of demonstrating the prototype of the system / subsystem in an operational environment and TRL 8 is a real system developed and approved.

DID YOU KNOW...

Water is a vital asset for different cultures, and, since antiquity, civilizations have developed in places close to water courses, such as rivers, lakes, the sea and others. Water quality had been a concern since 2,000 BC, as Persians punished anyone who polluted water resources. Water treatment has been recorded in ancient Egypt, around 1,500 B.C. There was a concern on the part of Egyptians about inappropriate water due to the transmission of diseases. For this reason, they carried out the water treatment using aluminum sulfate in order to clarify the water. The treatment of water was recommended by the ancient Sanskirts and Greeks. They carried out the storage in copper vessels, removed the “cloudiness" from the water by filtration processes, exposure to sunlight and boiling.



In 1855, John Snow proved that cholera was a waterborne disease. This happened through a case study in which he observed a street where there was a well or pit that was contaminated with water from a sewer, and on the other side, the waters ran away. He realized that people who drank water contaminated with sewage water almost all got sick, and with that, he was able to prove his theory. In the late 1880s, Louis Pasteur demonstrated the “Germ Theory" for disease. This theory explains how microscopic organisms can transmit diseases from water.

The origin of the word sanitation derives from the Latin and can have several meanings, among them is: to make healthy, habitable, to heal, to turn healthy and to restore. In Brazil, basic sanitation is a right ensured by the Constitution and by Law no. 11,445 / 2007. Sanitation consists of a set of services, infrastructures and operational installations for the supply of drinking water, sanitary sewage, urban cleaning, solid waste management and rainwater drainage. Use of water is necessary for the most diverse purposes, including for drinking purposes, such as: basic hygiene, domestic chores, irrigation, cooking and sanitation of food, among others. There are records that the Greeks used the water disposed in the sewers to irrigate the plantations, thus reusing the water.

REFERENCES CONSULTED

ALVES, P. F.S., SANTOS, S. R .; KONDO, M. K .; ARAÚJO, E.D .; OLIVEIRA, P. M. Fertirrigação do milho com água residuária tratada: crescimento e produção (Fertigation of corn with treated wastewater: growth and production). Revista Brasileira de Engenharia Sanitária e Ambiental (Brazilian Journal of Sanitary and Environmental Engineering). v. 23, nº 5, 2018.

Access water handbook on December 11, 2020: https://www.ufjf.br/nates/files/2009/12/agua.pdf.

Bioagua Booklet on Clima da Caatinga accessed on November 14, 2020: https: //www.noclimadacaatinga.org.br/wpcontent/uploads/no_clima_da_caatinga_cartilha_bioagua.pdf

GOUVEIA, A. R. Manual for use and maintenance of the Bioagua System. Project Enel Shares Infrastructure: Family Biowater., 2019.

LANDO, G. A .; QUEIROZ, A. P. F .; MARTINS, T. L. C. Direito fundamental à água: o consumo e a agricultura sustentável pelo uso dos sistemas de cisterna e bioágua familiar nas regiões do semiárido brasileiro. (Essential right to water: consumption and sustainable agriculture through the use of cistern and family bioagua systems in the regions of the Brazilian semiarid). Revista Campo Jurídico (Legal Field Magazine), v. 5, No. 1, p. 35-64, 2017.

OLIVEIRA, J. F .; FIA, R .; FIA, F. R. L .; RODRIGUES, F. N .; OLIVEIRA, L. F. C .; LUIS CESAR FILHO, A. L. Efeitos da água residual de laticínios na respiração basal do solo, produtividade e remoção de nutrientes por Tifton 85 (Cynodon sp.) (Effects of dairy wastewater on basal soil respiration, productivity and nutrient removal by Tifton 85 (Cynodon sp.)). Revista de Ciências Agrárias (Agricultural Sciences Magazine), vol. 42 (1), p. 155-165, 2019.

Revista Questão de Ciência (Science Question Magazine) accessed on December 11, 2020: http://revistaquestaodeciencia.com.br/questao-nerd/2019/04/15/john-snow-na-guerra-das-epidemias.

SAMPAIO, E.V.S.B .; SALCEDO, I.H. & SILVA, F.B.R. Fertilidade de solos do semi-árido do Nordeste. (Soil fertility in the semi-arid region of the Northeast). In: PEREIRA, J.R. & FARIA, C.M.B., eds. Fertilizantes: Insumos básicos para a agricultura e combate à fome. Fertilizers: Basic inputs for agriculture and fighting hunger. Petrolina. Embrapa, 1995. p.51-71.

SANTIAGO, F. DOS S .; JALFIM, F. T .; DOMBROSKI, S. A. G .; SILVA, N. C. G. DA; BLACKBURN, R. M .; SILVA, J. K. M. DA; MONTEIRO NETO, L .; VALENÇA, J. R. DE F .; NANES, M. B .; RIBEIRO, G. A. Manejo do Sistema Bioágua Familiar. (Management of the Family Bioagua System). [s.l: s.n.]

SANTOS, C. F .; MAIA, Z. M. G .; SIQUEIRA, E. S .; ROZENDO, C. A contribuição da Bioágua para a segurança alimentar e sustentabilidade no Semiárido Potiguar brasileiro. (Bioagua's contribution to food security and sustainability in the Brazilian semi-arid region). Sustentabilidade em Debate (Sustainability Debate). v. 7. Special Edition, p. 100-113, 2016.

SCHAER-BARBOSA, M .; SANTOS, M. E. P .; MEDEIROS, Y. D. P. Viabilidade do reúso de água como elemento mitigador dos impactos dos efeitos da seca no semiárido da Bahia. (Viability of water reuse as a mitigating factor for the impacts of drought effects in the semiarid region of Bahia). Revista Ambiente e Sociedade (Environment and Society Magazine), v. 17, p. 12-32, 2014.

SILVA. M .; OLIVEIRA, A. Processo de revitalização do sertão: uma prática necessária sobretudo em Quixeramobim-CE. (Process of revitalization of the hinterland: a necessary practice especially in Quixeramobim-CE). Revista de Geografia e Ordenamento do Território (Geography and Spatial Planning Magazine), nº 9, p. 263-279, 2016.

http://revistaquestaodeciencia.com.br/questao-

nerd/2019/04/15/john-snow-na-guerra-das-epidemias

https://www.ufjf.br/nates/files/2009/12/agua.pdf

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