# FILTRÓN

## CERAMIC FILTER FOR DRINKING WATER

IDEASS Nicaragua

Innovation for Development and South-South Cooperation

# Introduction

**By Marcia Estrada**

**FILTRÓN is** a low cost household filter which treats contaminated water in order to render it safe to drink. FILTRÓN basically consists of a filtering element that can be made by local potters using local materials, with no need for electricity or advanced technology.

**The Millennium** Summit goal for 2015 to "halve the proportion of people without sustainable access to safe drinking water" is impossible to achieve by conventional methods, because costs would be too high. FILTRÓN is an innovatory system that can help attain this objective by ensuring low cost drinking water to poor families. Furthermore, it uses a technology that can be applied by members of the family and which generates job opportunities for local artisans.

**FILTRÓN is** not just a filter. In terms of health, it provides safe drinking water, removing turbidity and eliminating bacteria, which cannot pass through its tiny pores. The filter is impregnated with colloidal silver, which produces a reaction that makes any harmful agents passing through the filter completely harmless for human beings. Since FILTRÓN is made of clay, which is the basis of all known cultures, it is culturally acceptable to communities. Socially, the consumption of clean drinking water reduces illnesses, protects the household economy and guarantees a motivated workforce for the production of FILTRÓN, thus generating local employment. As far as technology is concerned, FILTRÓN can be made by local craftsmen using local materials; only a brief period of training is required. Mass production, too, involves a minimal amount of equipment. In economic terms, it guarantees drinking water for a Nicaraguan family at a cost of US$10 per filter.

**FILTRÓN is** based on pre-Columbian American practices, which included working a clay pot from which they extracted uncontaminated water by tilting the container on its side; now a faucet is used instead. In 1980, Fernando Mazariego improved this system by introducing an application of colloidal silver. In 1998, Potters for Peace, an international NGO that trains potters from developing countries, made further progress by developing a large-scale production process, which substantially reduced costs from US$20 to US$10 per filter. An important part in all this was played by Ron Rivera, a sociologist and potter, who had a leading role in the process of improving and disseminating the technology at the international level.

**FILTRÓN has** received national and international recognition. Among the most important at the international level are the World Bank's "Marketplace 2004" Prize in Cambodia, awarded for the transfer of the technology from Nicaragua, and a prize awarded by the Association of Latin-American Health Engineers in1982.

**Potters for** Peace decided not to patent the technology, but to publish information on the INTERNET and make it public domain.

# What problem does it solve?

**FILTRÓN is** a household filtering unit for the treatment and storage of water. It filters water, removes turbidity and, thanks to the colloidal silver, disinfects it by deactivating any bacteria that pass through its tiny pores, thus successfully purifying contaminated water. Another important quality that FILTRÓN can guarantee is the secure storage of the treated water in the house. On passing through the filter, water deposits in a container equipped with a faucet so that no other object need be introduced to extract the water, thus guaranteeing hygiene.

**Household treatment** and safe storage units allow communities to treat contaminated water and attain quality standards that comply with norms set by the World Health Organisation (WHO). Due to low cost and ease of use, this technology can provide an immediate, though not definitive, solution to the problem of providing quality drinking water for the community. It is known that 80% of illnesses affecting the population are related to contaminated water, so there is a clear need for an innovative system in all developing countries. The consumption of safe water has reduced the risk of contracting diarrheic illnesses from 44% to 85%. In Nicaragua, 41% of the population does not have access to the drinking water services provided by the state water company. "Only 23% of the population has sustainable access to sources of improved water" (UNDP 2003).

## THE ADVANTAGES OF FILTRÓN OVER OTHER WATER TREATMENT SYSTEMS:

- It is an improvement on slow sand filters, and other filter systems that do not remove turbidity from the water. In addition to this, FILTRÓN also deactivates bacteria.
- It is an improvement on bottled water, which is expensive and occasionally of dubious quality. FILTRÓN guarantees users quality filtered water quickly and effectively.

## FILTRÓN compared to other methods of obtaining drinking water

| Method | Advantages of this technology | Disadvantages of this technology |
|---|---|---|
| Boiled water | 100% drinkable (if boiled for 7 minutes); technique is known and accepted by the population; water can be boiled all year round. | Time needed to boil the water (7-20 min.); long cooling down period required; pots are needed; affects the taste of the water; a container with a tap is needed to store the drinking water; fuel (wood or gas) and time needed to look for wood; turbidity not removed; cannot be done by children. |
| Chlorination | Effectively removes bacteria; simple to use; low cost; locally produced; technology accepted by the population; chlorinating can take place at any time of the year. | Affects the taste of the water; set procedures must be followed; an appropriate container is required with a lid and tap to store the water; must be bought and transported; turbidity is not removed; not always available; cannot be applied by children. |
| Sand filters | Cheap; locally produced; removes turbidity; can be done by the family; can be used in conjunction with chlorine and other disinfectants. | Strict maintenance procedures; fine sand cannot be found everywhere; bacteria is not killed; a container with a tap is needed to store the water; chlorine is needed. |
| Bio-sand filters | Eliminates bacteria; can be used in conjunction with chlorine; cheap; locally produced; removes turbidity; can be done by the family. | Strict maintenance procedures; regular cleaning required; cannot be done by children; requires two containers and faucet; degree of acceptance by population unknown. |
| SODIS Solar Pasteurisation | Eliminates bacteria; does not pollute; cheap; proved effectiveness; no fuel needed (wood, gas); easy to implement; no container required for storage; equipment found locally. | 4 hours needed to purify the water in the sun; cooling period required; place needed to store the water; changes the taste of the water; does not work in the shade or at night; strict procedures must be followed; turbidity not removed; degree of acceptance by population unknown; cannot be done by children. |
| Bottled or bagged water | Generally pure; national product. | Occasional doubts on suitability of water for drinking; containers pollute the environment; expensive. |
| FILTRÓN Colloidal silver clay filters | Eliminates bacteria; easy to use; purchased once only; does not affect taste of water; culturally acceptable since many cultures store water in clay pots or jars; keeps water fresh; water collected directly from container; produced by local artisans using local material; equipped with faucet; works all year round and at all times of the day; cheap; removes turbidity; can be used in conjunction with other methods to remove turbidity; low cost: US$10 (0.03 cents a day or 0.001 cents a litre). | Fragile; needs regular maintenance; fuel required for production; filter needs to be replaced each year (cost US$4). |
| Clay filters without colloidal silver | Easy to use; purchased once only; culturally accepted; does not affect taste of the water; keeps water fresh; water collected from container; made by local artisans using local materials; works all year round; can be combined with other methods to remove turbidity. | Does not remove pollutants; fragile; needs regular cleaning; fuel needed for production; needs to be renewed each year. |
| Procter & Gamble PUR Powder | Eliminates turbidity; eliminates bacteria; contains chlorine. | 20 litres cost US$0.10 in Nicaragua; two containers required, one with faucet and lid. |


**FILTRÓN has** been the subject of microbiological studies, tests and evaluations in 11 countries, all producing excellent results.

**A study** carried out by the Water Resources Research Centre of the National Autonomous University of Nicaragua on the effectiveness of the clay filters in removing harmful organisms has produced the following results.

## PERCENTAGE OF REMOVAL

| Sample code | Total coliforms | Fecal coliforms | Streptoccocus | E. coli |
|---|---|---|---|---|
| Control sample | 79000 ufc100ml | 68000 ufc100ml | 2800 ufc100ml | 550 ufc/100m |
| R – 83 | 100% | 100% | 100% | 100% |
| R – 128 | 99.88% | 100% | 100% | 100% |
| R – 168 | 100% | 100% | 100% | 100% |
| R – 213 | 100% | 100% | 100% | 100% |
| R – 214 | 100% | 100% | 100% | 100% |
| R – 215 | 100% | 100% | 100% | 100% |
| R – 223 | 100% | 100% | 100% | 100% |
| R – 308 | 100% | 100% | 100% | 100% |

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# FILTRÓN in practice

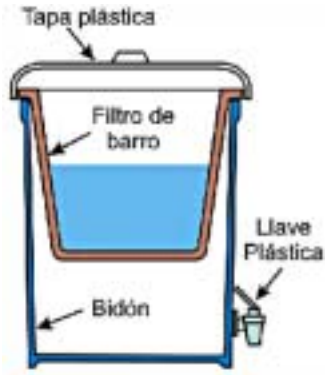
**FILTRÓN is** a very inexpensive product. The filter can be made by local potters using local materials, with no need for electricity or advanced technology. It consists of a mixture of 50% red clay and 50% sawdust, or similar organic material such as rice husk or coffee husk, depending on locally available material. Water is added to the mixture, which is then placed into a mould. This is then pressed using a truck jack, which is something that can be easily found.

**Once dry,** the filters are fired in a potter's kiln at 890 degrees centigrade. This creates a membrane of tiny pores that stops bacteria from getting through. Next, the filter is soaked in a solution of colloidal silver to prevent bacterial growth. This process makes the water drinkable and removes turbidity. To use FILTRÓN, the filter is filled with water and covered with a lid. Standard filtration rate is between one and two litres an hour. If a greater amount of water collects in less time, it is sign that there is something wrong with the filtering process.

**The table** on the previous page shows how much bacteria is blocked by FILTRÓN micro pores.

## Personnel and equipment needed to set up a filter workshop

- 1 professional potter with experience in collecting clay and making ceramic articles, semi-industrial and mass production
- 1-2 assistants, preferably potters
- 15 to 20-ton hydraulic press
- Filter moulds
- Clay and sawdust mixer
- Hammer mill
- Kiln with an internal area of at least one cubic metre
- Colloidal silver
- Racks, workbenches




## A complete FILTRÓN unit also requires:

- Plastic water tap
- 20-30 litre ceramic tank made locally or 20-30 plastic buckets with lids (which can be purchased locally)
- Instructions for use, preferably printed on the bucket or written on a waterproof transfer
- Micro biological tests (HACH)
- At least 100-square metres of covered area to begin operations

## Description of the manufacturing process

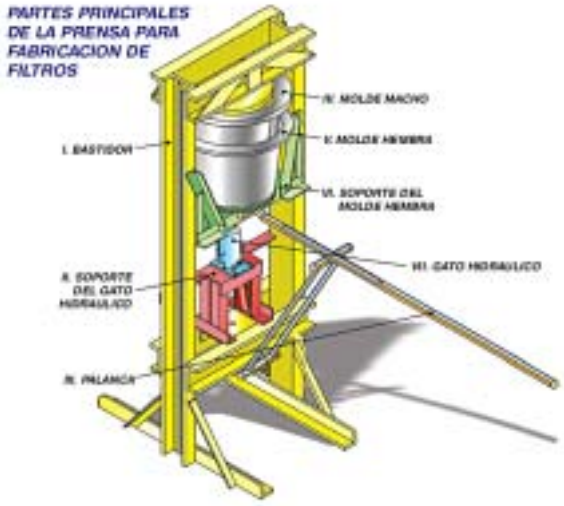
**The process** begins by grinding dry clay in a hammer mill; the milled clay is then passed through a fine screen mesh (size 30, like a mosquito net) to remove larger particles and any other impurities that the clay might contain. 60 lbs of clay are weighed on a scale (27.3 kg). The sawdust is also dried and is passed through the mesh (size 30) and the equivalent of 12 lbs is weighed (5.443 Kg).

**Then both** sawdust and clay are dry mixed for ten minutes either by hand or in a mixer at a speed of 60 rpm. Then, about 2.5 gallons of water (9.4 litres) are slowly added. It is mixed for another ten minutes until a homogenous consistency is obtained. Then the mixture is shaped into 16-pound balls and taken to a hydraulic press where it is placed in purpose-built moulds.

**The mould** consists of male and female sections and a plate to facilitate removal of the filter once it has been pressed. The male and female parts are covered with plastic to prevent the clay mixture from sticking to the mould and getting damaged. Then, the filters are placed on drying racks for one day.

**The second** day each filter is stamped with the workshop name and serial number. This is done for purposes of quality control on each piece; a register is kept of all filters delivered to each customer. Folds in the clay due to the plastic covering in the mould are smoothed out with a tool.

**Depending on** the weather, the fresh filters are left to dry for a period of between 5 and 21 days. Nicaragua has special drying rooms where they can be dried in four days throughout the year. Once the




filters are completely dry, they are fired in a kiln at a temperature of 890 °C for 9 hours. A digital pyrometer is used to ensure that the temperature is correct and pyrometric cones are used to make any necessary adjustments. Afterwards, the filters are left to cool in the kiln until they reach room temperature. Then the pots are taken out of the kiln and placed on racks for semi-finished products.

**Once cool,** they are soaked in water overnight so that the water permeates all the pores that have been formed by firing the sawdust. Then a test is carried out to check the filtration rate, which must be between one and two litres an hour. Any filters that do not meet this requirement are destroyed.

**Records of** the tests are kept in a book together with the serial number for each filter, production date, the date it was fired and the filtration rate.

**Next,** a mixture of water and colloidal silver is prepared. Two millilitres of colloidal silver at 3.2% is added to 250 millilitres of water. When the filter is perfectly dry it is dipped into the solution; alternatively the solution can be applied using a brush.

**Pictures illustrating** the production process can be found at www.elfiltron.com in the important documents section.

# Results

**FILTRÓN technology** has spread quickly. It is easily acquired because it responds to community needs and uses components that are common to many different world cultures.


**The rapid** spread of FILTRÓN has made it the subject of numerous studies and laboratory tests carried out by:

- Massachusetts Institute for Technology (MIT, USA)
- USAID
- CIRA/UNI (the National Engineering University's Water Research Centre)
- CIDEA/UCA (the University of Central America's Water Ecosystems Research Centre)
- Zamorano University (Honduras)
- Rafael Landivar University (Guatemala)
- University of Colorado (USA)
- University of Tulane (USA)
- University of North Carolina (USA)
- International Federation of the Red Cross
- CITA/Cuba (Institute of Hydraulic Resources)
- Engineers without Borders
- Health Ministries of Guatemala, Honduras, Mexico, Nicaragua, Ghana and Guatemala

**All tests** showed that the filter was successful in technical terms and that health education and hygiene were required.

**Potters for** Peace has facilitated production by standardising filter size. Filtration rate is set at one to two litres an hour, verified during quality control. Production potential is 1,000 to 4,000 filters a month.

**Since the** technology is easy to acquire and the production process quick to set up, FILTRÓN is at present disseminated in 13 countries.

**The initial** outlay is US$ 10.00, and another US$ 4 for the annual replacement of the filter. Cost comes to US$ 0.03 per day or US$ 0.001 per litre of water.

**FILTRÓN reduces** the risk of illness caused by consumption of contaminated water by 50%. Health education, hygiene and monitoring ensure product effectiveness.

# International interest

**AN IMPORTANT ROLE HAS BEEN PLAYED IN THE DEVELOPMENT OF FILTRÓN BY MANY IMPORTANT INTERNATIONAL ORGANISATIONS:**

- ICAITI Guatemala (BID, 1981) made a comparative study of 10 filters.
- AFA Guatemala (Inter-American Foundation) funded an epidemiological study involving more than 700 families.
- MAP International, backed by funds from USAID, organised a mission by Fernando Mazariegos and an ICAITI chemist from Guatemala in 1984 to train indigenous Quechua in the Ecuadorian Andes.
- Practica Foundation/Holland presented FILTRÓN at the 2001 Johannesburg Summit (South Africa); the International Water Meeting in Kyoto (Japan), 2002; the UN International Conference on the Treatment of Water in Durban (South Africa), 2003; the International Safe Water Meeting in Nairobi (Kenya), 2004; the International Water Association Conference in Marrakech (Morocco) 2004.

**Potters for** Peace presented FILTRÓN at the Bilateral Border Water Meeting in Tijuana (Mexico), 2002; the International Sustainable Resources Conference (United States), 2003.

**FILTRÓN has** been recognised by important international institutions, and the technology is used in health, water and emergency projects: Plan International; World Vision; Save the Children; Doctors Without Borders; International Federation of the Red Cross; CITA/Cuba (Institute of Hydraulic Resources); Project Concern International; UNICEF; Doctors of the World. Oxfam UK is considering the technology for use in Sudan.

**FILTRÓN has** also been recognised by the World Bank (World Market Place Grant); CONICYT (Nicaraguan Government Science and Technology Council); Practica Foundation Holland; Engineers Without Borders (USA); USAID.

**FILTRÓN was** awarded the World Bank's "Market Place 2004" Prize in Cambodia and received first prize in CONICYT's Human Development Innovation Fair held in Nicaragua in 2004.

**FILTRÓN workshops** have been set up in the following countries: Mexico, Guatemala, Honduras, Nicaragua, Haiti, Cuba, Myanmar, Indonesia, India, Bangladesh, Ghana, Cambodia and Vietnam.

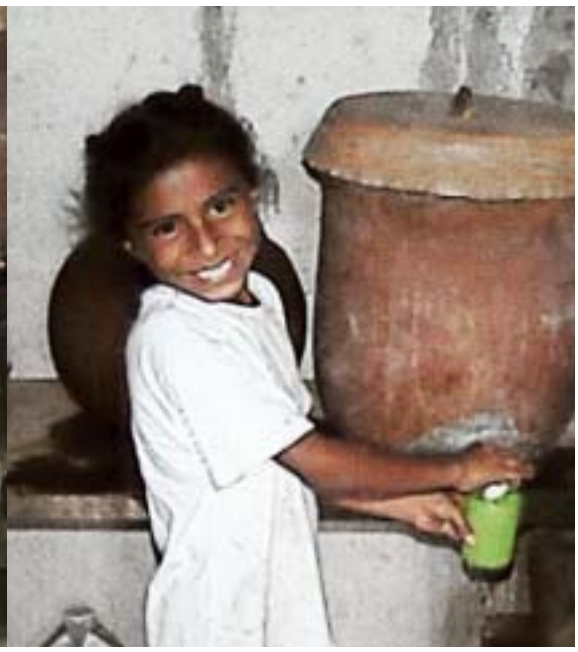
**Potters have** received training on the production process in Ecuador, Bolivia, Iraq and the United States. Plans are underway to set up production centres in El Salvador, Colombia, Argentina, Kenya and Sudan.

# Adopting FILTRÓN in other countries

**Potters for Peace require a commitment from cooperation organisations or private enterprises interested in setting up production and commercialisation of FILTRÓN in other countries to guarantee:**

- Affordable prices for the poorest members of the population in each country.
- Sustainability, quality control, health education, follow-up, monitoring and evaluation.
- Technical assistance, customer service, and participation in research and development. Potters for Peace hope that information will be shared with other filter producers in other countries.

Potters for Peace made a political decision not to patent the technology, but to publish information on the INTERNET and make it public domain.



# To learn more

**DETAILED INFORMATION ON FILTRÓN CAN BE FOUND IN THE FOLLOWING WEB SITES:**

www.potpaz.org
www.elfiltron.com

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# Who to contact


**Ron Rivera**
Potters for Peace/Nicaragua
Post Box 3868
Managua, Nicaragua
Tele/fax 505 278 8519

ronriverat@yahoo.com
pottersforpeace@yahoo.com

**The IDEASS** Initiative - Innovation for Development and South-South Cooperation - is promoted by the following international cooperation programmes: ILO/Universitas, UNDP/APPI, and by the UNDP/IFAD/UNOPS Human Development and Anti-Poverty Programmes, currently active in Albania, Angola, Colombia, Cuba, El Salvador, Guatemala, Honduras, Mozambique, Nicaragua, the Dominican Republic, Serbia, South Africa and Tunisia. The cooperation initiative grew out of the major world summits in the 1990s and the Millennium General Assembly; it gives priority to cooperation between protagonists in the South, with the support of the industrialised countries.

**The aim** of IDEASS is to strengthen the effectiveness of local development processes through the increased use of innovations for human development and decent working conditions. By means of south-south cooperation projects, it acts as a catalyst for the spread of social, economic and technological innovations that favour economic and social development at the local level. The innovations promoted may be products, technologies, or social, economic or cultural practices. For more information about the IDEASS Initiative, please consult the website: www.ideassonline.org.

# ideass

## Innovation for Development and South-South Cooperation

UNDP's Anti-Poverty Partnership Initiatives (APPI) Programme is a tool designed to assist governments and social actors to establish and apply national policies for reducing both poverty and social exclusion, based on local integrated and participatory development practices.

The human development and anti-poverty programmes run by UNDP, IFAD, ILO and UNOPS promote integrated and participatory local development processes within the framework of national policies, with the support of public, private and civil society actors. These programmes provide the framework within which donor countries and communities in the industrialised countries can collaborate in an organised way, through descentralised cooperation. It is in this framework that south-south cooperation projects will be carried out via the Initiative.

The ILO/Universitas programme (decent work through training and innovation) encourages the use of innovative solutions to problems in human development, especially in the world of work. To achieve this, it carries out action-research activities and trains decision-makers and personnel working in local development.