



DEVELOPMENT OF CERAMIC WATER FILTER SYSTEM: ITDI Experience

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Department of Science and Technology**



Introduction



World Water Forum estimates

- 1.4 billion people lack clean drinking water
 - 2.3 billion people lack adequate sanitation
 - 7 million people die yearly from diseases linked to water
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- ◆ Problem with water pollution and accessibility to potable drinking water has become a global crisis



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Philippine Scenario

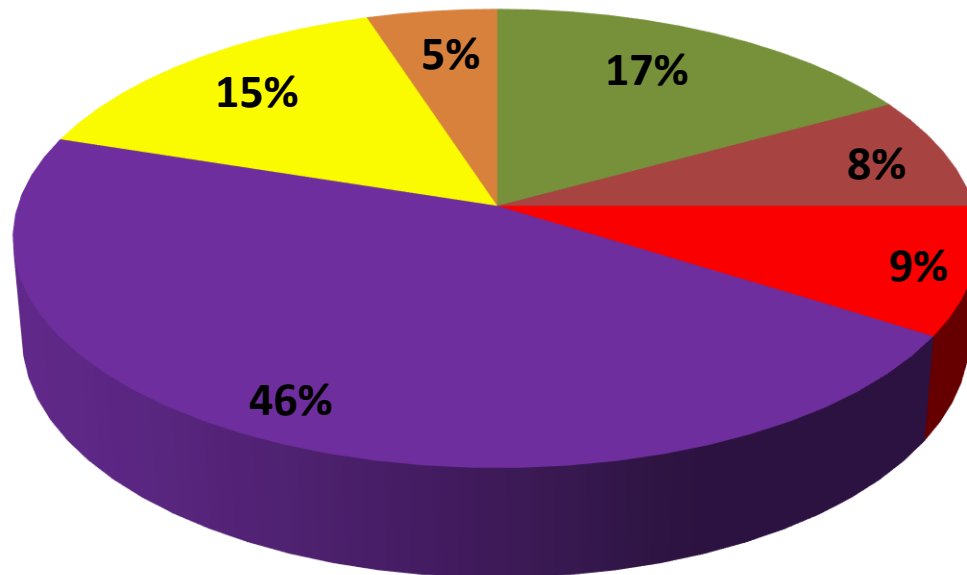


In the Philippines, access to clean and safe drinking water remains a problem both in rural and urban areas

- ◆ 20% of the total population or 3.2 million families have no access to potable water (*National Statistics Office, 2002*)
- ◆ 432 waterless municipalities or 1.5 million households outside Metro Manila have no access to safe drinking in 2010 (*Department of Interior and Local Government*)
- ◆ Nearly 6,000 premature deaths a year caused by water-borne diseases (*Philippine Institute for Development Studies*)



Potable Water Supply Sources



- Water Districts
- Big Private Operators
- Self-Provision
- Community-Based Association/NGO's
- Unimproved Water Sources/Roofwater
- SSIP(mostly truckers)-suppliers



S & T Intervention

- ◆ Contaminants such as microorganisms and particulates present in tap and ground water cause the spread of water-borne diseases
- ◆ Micro-filtration [e.g. ceramic-based micro-filters (0.1-50 μm)] is a proven technique to take out such contaminants



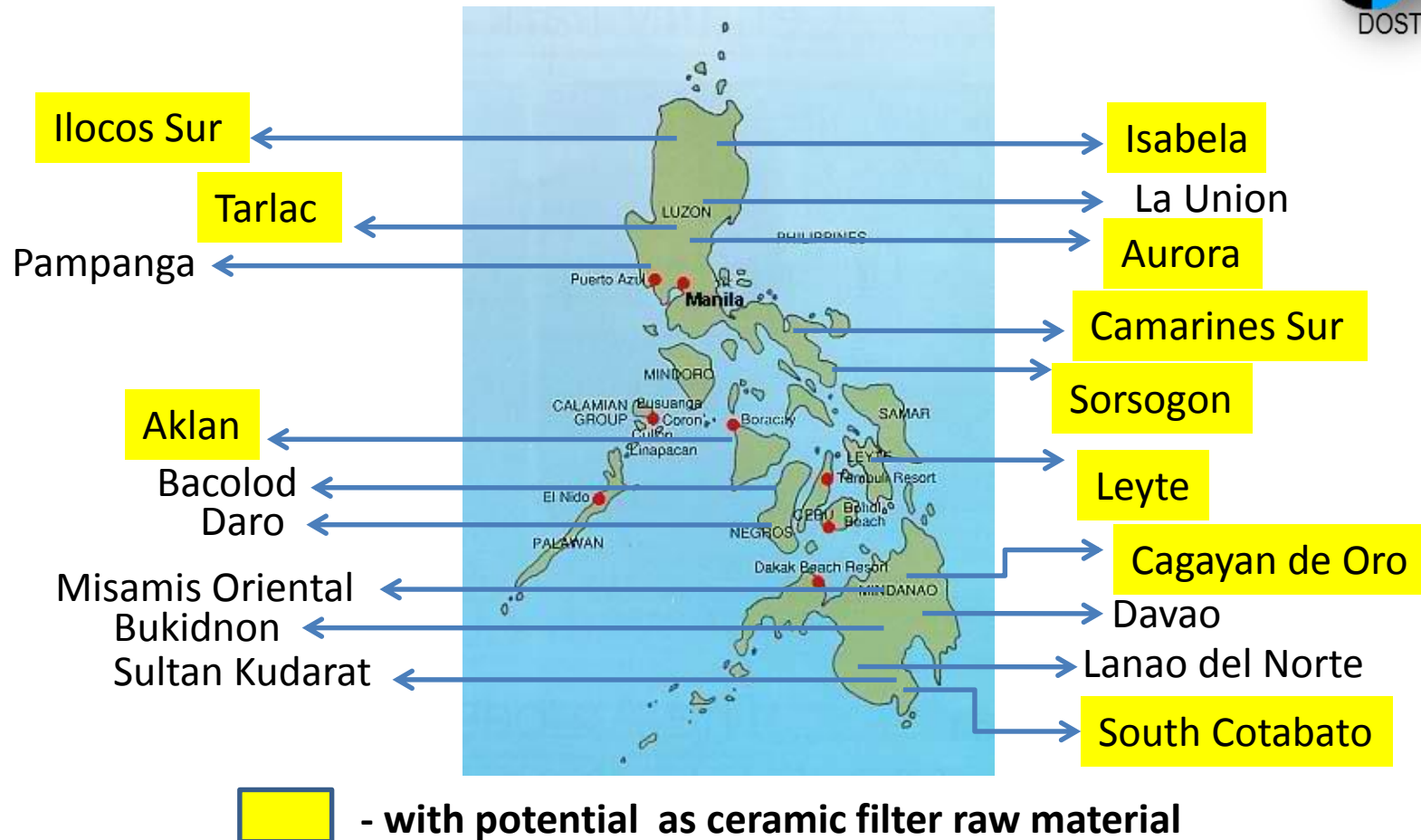


S & T Intervention

- ◆ The DOST thru ITDI can provide an innovative solution in ceramic filtration to take out microbial/particulate contaminants in drinking water for use in household level
 - *Develop ceramic filters with anti-microbial coating*
 - *Utilizes local abundant raw materials: red clay*



Potential Sources of Clay Samples



Ceramic Filter Systems



6.0 Liters Capacity



1.5 Liters Capacity





Description/Features

- ◆ Formulated with red clay and coated with nano-antimicrobial agent to eliminate water borne microorganisms;
- ◆ Purifies tap water, deep well water and raw water (e.g. from springs);
- ◆ Lodged in a plastic container provided with a faucet at the bottom for collection of the filtered water.



Physical Properties of Ceramic Pot Filter



Properties	
Total Shrinkage, %	$\leq 25\%$
Water Absorption, %	50% - 55%
Apparent Porosity, %	70 - 80%
Bulk density, g/cm ³	1.20
Flow rate, L/hr	2-3



Benefits/Advantages

- ✓ Easy to install/assemble
- ✓ Easy to handle and maintain
- ✓ Reasonably priced
- ✓ Makes safe, potable drinking water readily available and accessible even in remote areas.



Operation

- Water from source is poured into the ceramic pot. The water slowly passes through the pores and is collected in the lower container.
- The filtered water is stored in the container until needed, protecting it from contamination.



Field Performance Testing

- ◆ Distributed pot filters to NHA households in Muntinlupa City and Cagayan de Oro City

Feedbacks/Comments

- *Nagagamit sa pagluluto*
- *Masarap ang lasa ng tubig*
- *Nakatipid sa pagbili ng mineral water*
- *Medyo mabigat*
- *Kailangan maingat sa paglinis*
- *There was no reported/observed adverse effect on users*



Micro-Filtration Performance Test



- ◆ Type of Test – Microbiological Quality (raw water vs filtered water)
- ◆ Test Process:
 - Ceramic Pot Filters were distributed among selected households in the NHA housing in Muntinlupa.
 - Water from NHA deep well system was used as test sample and fed into the ceramic pot filters
 - Filtered water samples were gathered from subject households and tested for microbial quality alongside unfiltered water from the same deep well system
- ◆ Testing Laboratory: Microbiology Laboratory, STD-ITDI



Microbiological Quality Test Results



Test/Analysis	Test Results			
	Raw Water	Remarks	Filtered Water	Remarks
Heterotrophic Plate Count (per ml sample, in agar plate, 35°C, 48 hour incubation)	37, 000	Failed	< 30	Passed
Test for coliform (per 100 ml sample,)	Positive	Failed	Negative	Passed
MPN of coliform organism (present in 100ml sample)	4.6	Failed	< 1.1	Passed
Test for E. coli (per 100 ml sample)	Negative	Passed	Negative	Passed
MPN of E. coli (present in 100ml sample)	> 1.1	Failed	< 1.1	Passed

PNS for drinking water: HPC: < 500 colonies per ml
Test for Coliform : Negative
Confirmed Test for coliform : < 1.1



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Product Details



Specifications/Costing	M O D E L	
	Ceramic Pot Filter	
	6.0 L	1.5 L
Weight , kg (Ave)	3.2	0.9
Max Flow Rate (NHA Deep Well)	3 L/h	n/a
Max Flow Rate (Tap Water)	3 L/h	2 L/h
Production Cost / pc	₱ 850	₱ 350
Cost of Plastic Assembly	₱ 225	₱ 75
Unit Cost (ceramic+plastic)	₱ 1, 075	₱ 425

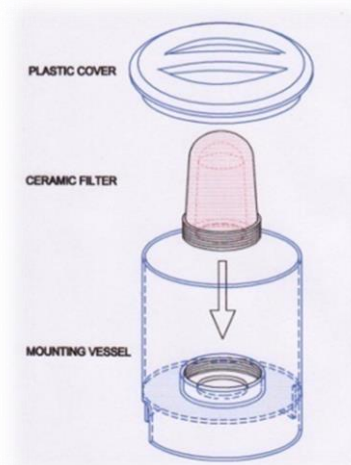


New Design

PRODUCTION OF CANDLE TYPE CERAMIC FILTER



Green wares (Vigan red clay)



Candle Type Ceramic Filter Assembly



New Design – Candle Type Ceramic Filter



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Raw Materials Characterization



- ◆ Raw materials testing and evaluation
- ◆ Assessment of the red clay deposit

PROPERTIES	RESULTS
Ave. H ₂ O of Plasticity, %	34.45
Ave. Drying Shrinkage, %	10.34
Workability/plasticity	Good
Raw Color	Grayish brown
Dry Color	Light grayish brown



Product Characterization

- ◆ Fired product testing and evaluation
- ◆ Optimization of process parameters



PROPERTIES	RESULTS
Firing Shrinkage, %	0.78
Total Shrinkage, %	11.12
Water Absorption, %	19.4
Porosity, %	30.6
Bulk Density, g/cc	1.57
General Appearance	brick orange
Compressive Strength, kg/cm ²	170.9
Flowrate (formulated body), L/hr	1.5 – 2



Microbiological Quality Test Results



Test/Analysis	Test Results			
	Raw Water	Remarks	Filtered Water	Remarks
Heterotrophic Plate Count (per ml sample, in agar plate, 35°C, 48 hour incubation)	47,000	Failed	< 30	Passed
Test for coliform (per 100 ml sample,)	Positive	Failed	Negative	Passed
MPN of coliform organism (present in 100ml sample)	> 8.0	Failed	< 1.1	Passed
Test for E. coli (per 100 ml sample)	Positive	Passed	Negative	Passed
MPN of E. coli (present in 100ml sample)	> 8.0	Failed	< 1.1	Passed

PNS for drinking water: HPC: < 500 colonies per ml
 Test for Coliform : Negative
 Confirmed Test for coliform : < 1.1



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Field Performance Testing



Shelternville Resettlement Area, Vigan, Ilocos Sur



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Product Details



Specifications/Costing	MODEL
	Candle-Type Ceramic Filter
Weight , kg (Ave)	0. 5
Max Flow Rate	2 L/h
Production Cost / pc	₱ 238
Cost of Plastic Assembly	₱ 112
Unit Cost (ceramic + plastic)	₱ 350



Water Consumption



- Water Consumption: 8 glasses per day/person = 2.0 L
(1 glass \cong 250 mL)
- Costs of purified water: 1 container (16 L) \cong ₱25.00 ~35.00
(Ave.= ₱ 30.00)
- For a family of 4, water consumption is about 8.0 L/day.
Therefore, 1 container is good for 2 days. For one month consumption, total expenses is ₱ 450.00. For one year consumption, total expenses is ₱ 5,400.00
- CCWF (2 L/h) and 4 h usage = 8.0 L
CCWF is good for 1 year usage with system cost of ₱ 350



Technology Updates



- Conducted initial training on the production of ceramic filter at DARS Ceramics, Cagayan de Oro City
- Continued provision of technical assistance to the adopter in Pampanga and Vigan in the production of candle type filter
- Consultancy/technical assistance being provided to other regions (I, II, V, VI, VIII, X and CAR)





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