

**FABRICATION AND PERFORMANCE STUDY
ON MODIFIED
LOCAL-MADE EARTHENWARE POTS
AS FILTER POTS
FOR THE PRODUCTION OF POTABLE WATER**

Ph.D. DISSERTATION

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ABSTRACT

Model earthenware filter pots to produce clean and safe water were fabricated from available local clay materials adapting the traditional state of art of Myanmar mode of pottery making. The raw clays used in earthenware pottery making were unlike the quality ceramics grade clays, china and ball clays; it was of the lateritic kind of mineral, probably an iron-alumino-silicate. It was found to be composed of 5-6 % Fe_2O_3 and about 2.5 in proportional ratio of SiO_2 to Al_2O_3 , and less than 1% of alkaline earth and alkali metals. Its volatile material or LOI (loss on ignition) is about 5-6 %. The clay minerals were of two kinds, the one dark clay and the other red clay. The dark clay imparts the plasticity and consistency property when red clay was mixed with it, particularly when it was wetted with 2 or 3 times in proportion of water.

Field studies indicated that among the local pottery making areas, namely Bago, Twante, Shwebo and Sagaing, the Sagaing area was selected because the field site still adapt the conservative traditional state of art of pottery making, i.e., using the handicraft potter's wheel. Moreover, materials like the raw dark and red clays were readily available from a near by river bank; the aid materials like sand and gravel were also readily available, also available were the skill labour and fuels like wood and straw. The hot dry climatic conditions also favour the working conditions.

The working at the Sagaing pottery making site, enables one to use the family handicraft potter's wheel. Thus, filter pots were fabricated, fashioned and shaped into suitable forms and sizes. Since, local earthenware pots were found to be unfit to be used as filtration pots; earthenware filter pots were improvised and modified to meet the permeation rates of filtration characteristics of a filter pot.

The results of the investigations showed that a 1:1 proportion of dark clay to red clay (< 1mm mesh size) provide an optimum condition to produce a plastic mixture when wetted with three times the proportions of water. Kneaded plastic lumps were then fashioned into desired shapes and sizes by means of a

potter's wheel. The soft plastic like cylinder pots were then chapped (strike) with 100 g (< 1 mm mesh size) of coarse sand to create porosity. The manipulative skills of the potter is one important factor in this hand making process of a porous filter pot., since no moulding blocks are used in the process. The state of art is nurturing the pots, in the shade and under direct sunlight for 5 days. The sun baked pots were then wood-straw fired in a temporary make shift circled kiln, the temperature of which is just below 1000°C. A batch of vitrified pots was achieved, about 94 - 95 % from out of a total of 100 modified pots.

Performance studies with respect to permeation and filtration characteristics were made on available earthenware water pots and found that the common water pots do not meet the requirements of filter pots. Performance studies on fabricated modified filter pots assessed in terms of filtration coefficients and permeability coefficients showed significant and substantive values. The filter pots relevant to filterability parameters in terms of apparent permeability coefficient, (K') i.e., flux and filtration coefficients 'Kp' which according to Darcy relationship were found to be as follows:

	1.5 time	300 - 400 times
Fabricated cylinder shape filter pot	>> modified filter pot	>>>> local earthenware pot
K' (ml hr ⁻¹)	500-600	400-450
Kp x 10 ⁶ (min m ⁻⁶)	9.0	12.0 (no defined plot)
B x 10 ³ (min m ⁻³)	205.0	207.0
		impervious to flow
		no result
		no result

The inverse of Kp is a measure of the quantitative rate. It shows the porous nature of the media. Higher values of Kp are impervious to flow or resistance to flow. The inverse of B is a measure of flow. It is a factor that corresponds to thinness or thickness of the filter median. Kp and B are related to loaded pressure. In gravitational flow, Kp is more significant than B. B is being a dimensional factor. The modified pots were found to show effective removal properties, such as odour, colour (~100%), turbidity (81 %), hardness

(84 %), salinity (Cl^-) (~ 75%), and total organic carbon (80 %). It was the capacity to filter out (~ 100 %) bacteria (*E-coli*) and also some toxic metals like As (75 %) and Pb (80 %). An even balance of pH was maintained i.e., (6.9 to 7.0). Also, the filtrate as storage water remains clean and safe to drink.

A handy improvised electrolyser was also able to provide an ample solution of 1 ml (NaOCl or HOCl) sufficient to be free of bacteria or pathogens from the feed or storage water. Because the filter pots units can be produced by a rural area potter, its cost will be low and rural households may be able to store clean and safe water by using it. The modified cylinder shape earthenware filter pot (6.0 L) created as a model unit named as e-Filpot which possessed all the unique filterable properties can be called the Myanmar natural water-purifier.

Key words: Filter pots, Myanmar earthenware, clay, apparent permeability, filtration coefficient, modified and fabricated filter pot, performance parameters, water quality.