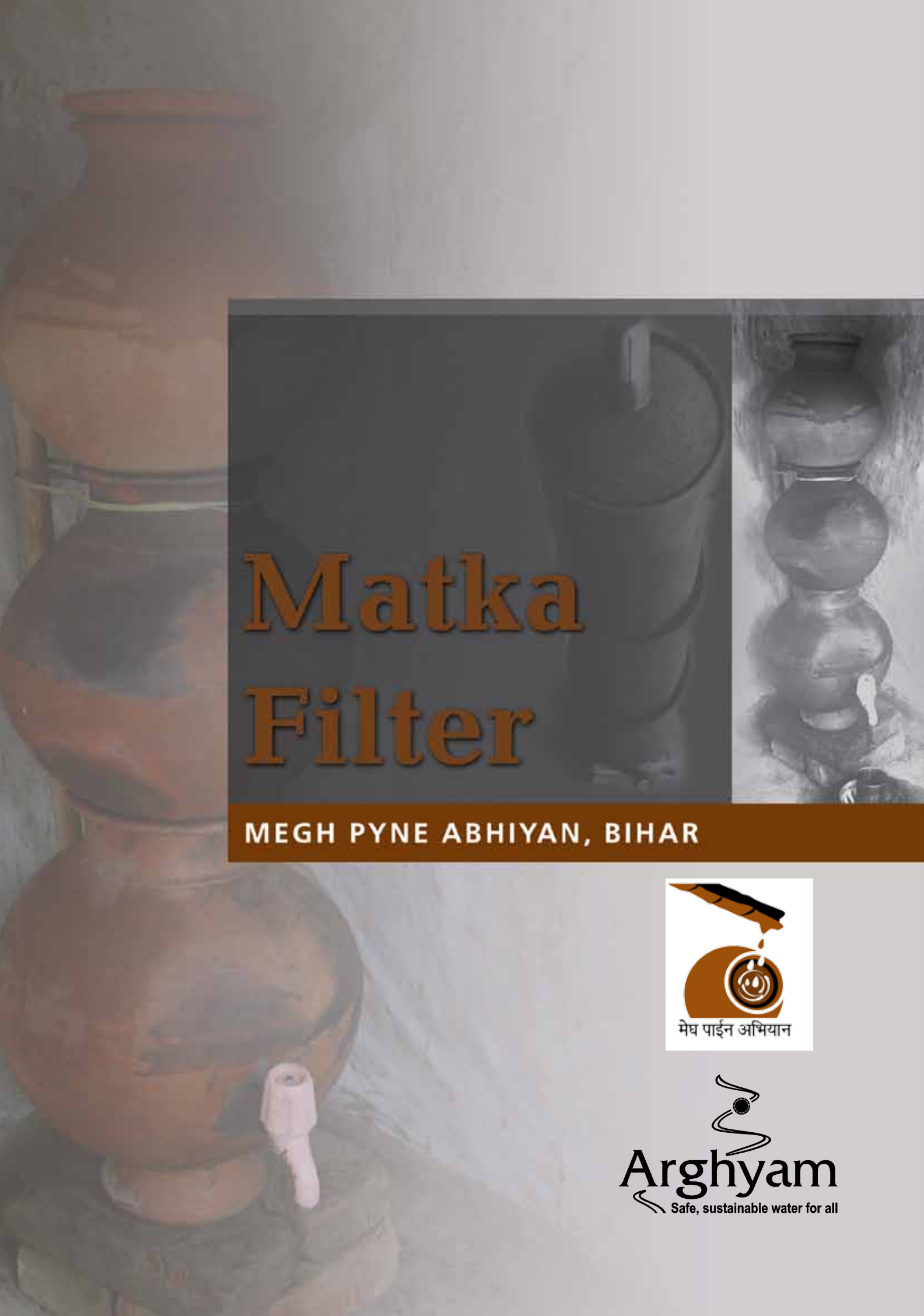


Matka Filter

MEGH PYNE ABHIYAN, BIHAR

मेघ पाईन अभियान

Arghyam

Safe, sustainable water for all

TECHNICAL DOCUMENT ON MATKA (EARTHEN) FILTER DESIGNED AND IMPLEMENTED BY MEGH PYNE ABHIYAN IN FIVE DISTRICTS OF NORTH BIHAR.

About Megh Pyne Abhiyan

Megh Pyne Abhiyan (Cloud Water Campaign) is based on the belief that every individual has a right to lead life with 'dignity, determination and dominance'. It is a commitment towards a behavioural change amongst the rural communities to effectively revive, innovate and institutionalize water and sanitation management practices and mainstream issues concerning floods through collective accountability and action. The campaign is a functional network of grassroots organizations and professionals working in five flood prone districts (Supaul, Saharsa, Khagaria, Madhubani, and Pashchim Champaran) of north Bihar.

North Bihar- Introduction

Megh Pyne Abhiyan (MPA) in its initial days carried out action research in the flood prone regions of North Bihar. After studying the four districts (Supaul, Khagaria, Saharsa and Madubani) and understanding the problems that arise during floods, the research concluded access to pure drinking water as one of the challenges and main problems during floods. Subsequently, MPA spread awareness about using local resources and techniques to harvest rainwater to meet the drinking water requirements during floods . This was the first experiment in rainwater harvesting in North Bihar which received positive response from the community and since then the concept and related practices have been evolving.

Information on Iron Concentration in Ground Water

After the first phase of the campaign (May - Nov 2006), the campaign organized "Jal Manthan Shivir", a camp on thinking and discussing water with campaign members to develop a collective road map for MPA. Based on the efforts undertaken in the first phase and the information obtained from the people during a survey initiated in the second stage, the members of MPA analyzed the strengths, weaknesses, opportunities and threats (SWOT) of the initiative. The SWOT analysis exercise had generated vast information on matka scenario throughout the year and its probable impact on human lives. Out of the all the perceptible water problems, excessive iron in groundwater remains to be the most prevalent and pervasive in the region, resulting in sizeable population suffering from gastro-intestinal problems. The burgeoning of chapa kals (handpumps) in the region (marketed as affordable, uncomplicated, trouble-free, undemanding and secure drinking water technology) coupled with total obliteration of local drinking water systems (yielding water with iron far less than the permissible limits) were being cited as reasons for the spread the gastro-intestinal problems in the region.

During the initial days, the campaign itself was depending on local perceptible indicators (smell, taste, and tinge) asserting the presence of iron in groundwater. However, with the scientific water testing exercise and local iron identification technique, MPA was able to pronounce the extent of the problem with certainty.

Local Technique Used to Detect Presence of Iron in Ground Water

Test Name: To illustrate the presence of iron in ground water using leaves of guava (Psidium guajava) leaves.

Requirements: Two clean glass tumblers; Two - four fresh green leaves of guava

Procedure: Fresh leaves of guava are crushed with hands. The crushed leaves are then dipped inside one of the glass tumbler with the water that needs to be tested. The colour of the water changes depending upon the extent of iron content in it. Various shades of purple define the extent of iron in water. If the iron content is less then the water will have light traces of purple. The water turning dark purple almost looking black is an indication of iron content being excessive. The entire procedure takes just few minutes and can be easily executed by everyone. The outcome of the indigenous technique has been corroborated with the scientific water testing procedure and there have been no discrepancies concerning the test results. To make the test more authentic, it is preferred to test another water sample (bottled water or water from a dug well) simultaneously to show the difference between the two sources as in the second case the colour does not change.

Inference: Change of colour of water to different shades of purple indicates the presence of iron in the water. In sample which appears light green in colour the concentration of iron is very low.

This technique of detecting the presence of iron in water by using guava leaves is an indicative one only. This technique helps in obtaining immediate information about the drinking water source. This technique was shared with MPA by Mohammed Murtaza, a senior citizen with basic education, from Chapkahi village in Piprakhurd panchayat of Supaul district. The perceptible indicators of the presence of iron in drinking water obtained from handpumps as mentioned by the villages was corroborated by the guava test.

Early Efforts by the Government

To address the problem of excessive iron levels in drinking water, the Bihar Government had set up one of the largest water quality improvement schemes in the state. The Kosi Amrit Peyjal Yojana (KAPY) was operating in nine districts, benefiting over 6,000 villages and five million people. Through the KAPY scheme, two iron removal plants were set up in each project village. Water treatment at these plants was based on simple iron removal technology developed at a local polytechnic. Since locally available material was used in the plants, construction was easy and economical. The estimated cost of each plant, based on 1998 rates, was Rs 10,830.00 which included the cost of the lift pump. Maintenance costs were estimated to be Rs 250 per year. The Government of India had funded the scheme, with UNICEF meeting 10 per cent of the project cost.

Testing Water Quality Scientifically

On one hand, lack of knowledge and technique to check the groundwater and on the other deteriorating health conditions of people in the rural areas, prompted the campaign to take up the challenge of spreading 'informed scientific knowledge' across to people about the status of groundwater and its impact on human body. As a strategy, the campaign first decided to take up water testing in order to develop an understanding about the quality of groundwater and other water sources in all the five districts.

Based on the information obtained from people and from results using traditional technique of knowing iron contamination in groundwater, a need for assessing groundwater quality was felt. Thereupon, with the help of a New Delhi based non government organization - Development Alternatives (DA) a training program on using DA's Jal-Tara Kit for testing groundwater quality was organized in 2007. Along with this, in the same year, water quality testing of all the public water sources like handpumps, dug wells etc was undertaken in the campaign districts of Supaul, Saharsa, Khagaria, Madhubani and Pashchim Champaran. The results of the tests were as follows:

TABLE 1

District	No. of Handpumps Tested	Handpumps with Iron levels higher than the desired level	Percentage of Handpumps with high iron levels
Supaul	121	103	85.12%
Saharsa	126	90	71.43%
Khagaria	113	91	80.53%
Madhubani	121	57	47.11%
Pashchim Champaran	18	11	61.11%

After analyzing the results obtained from campaign districts wide water quality testing, MPA started thinking about remedying the hand pumps showing iron levels more than the maximum permissible limits.

Attempting a Solution

Seeing iron presence in groundwater and its effects on the people, the campaign started exploring ways of locally addressing this problem. In spite of its shortcomings, the lessons from "Kosi Amrit Payjal Yojna" proved important for MPA. The lessons learnt from this project were:

- Reasons for developing linkage between the smallest unit and the most complex whole of the rural society

- Element and extent of decentralization within a community based initiative
- Inclusive character of an initiative in concept and practice
- Defining the concept of 'local', 'resources', and 'partnership'
- Program format

A simultaneous exercise was carried out in the field by MPA to identify practices that were being adopted by villagers to overcome the problem of excessive iron in drinking water. It was in Supaul that the campaign came across home-made filters that were being used for filtering iron laden groundwater. It was developed locally and on the concept of sand based filtration with the help of two matkas (earthen pots). Though the technique was helping the villagers to drink iron free water, but the design of the local filters exposed the beneficiaries to secondary sources of contamination. After assessing the need and benefits of the local filter, MPA decided to promote this technique with few structural modifications as necessary safeguard for maintaining the quality of drinking water. Several rounds of consultation and deliberation preceded the approval of the structural design for the local filter. The local filter was termed as matka filter by MPA.

Name of the utility: Matka (Earthen Filter)

Matka filter's construction can be divided into two parts.

1. Construction of outer body of matka filter

This is completed in two stages-

Shaping the body- the artisan shapes the filter manually and this done in the following order:

Construction of filter:

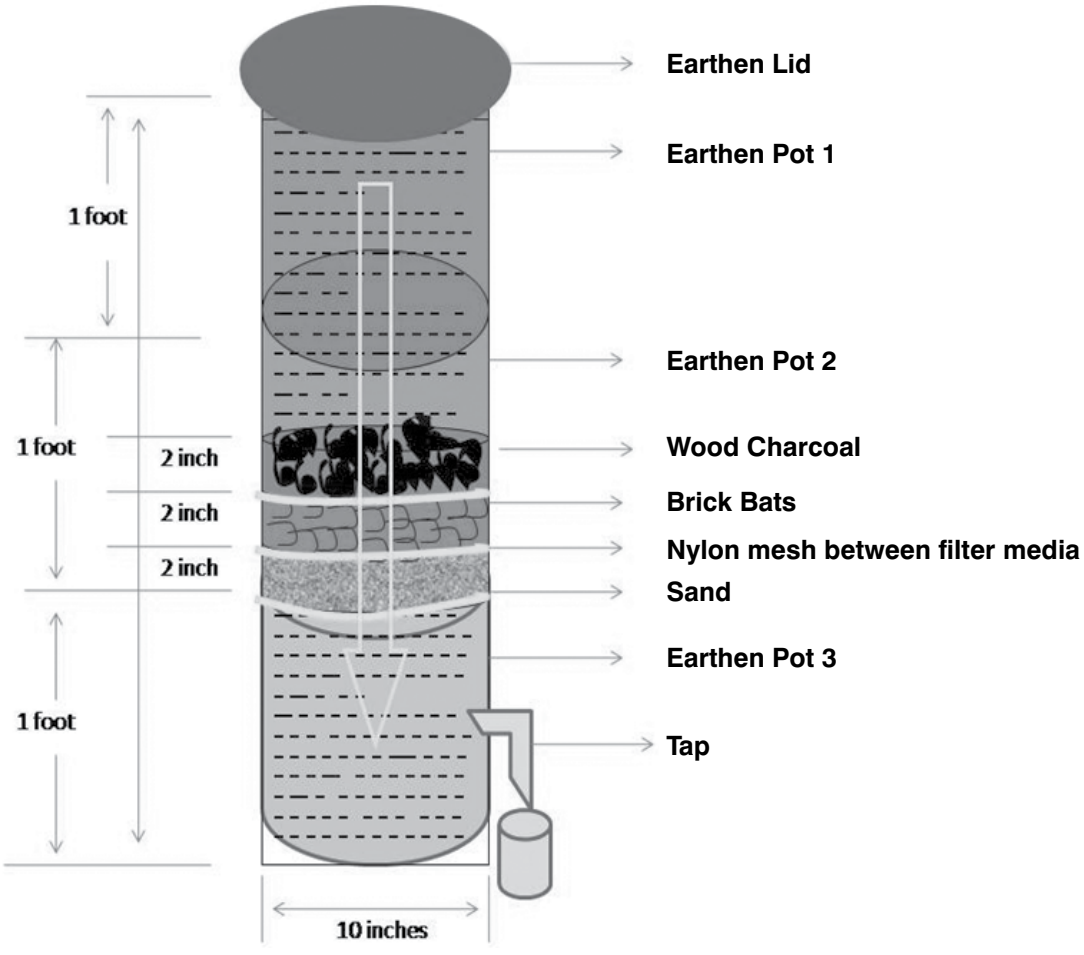
Materials required- clay, fine sand, and hay or saw dust.

Required proportions- 1:1:5 (1 part saw dust/hay, 1 part fine sand, 5 parts clay)

Process- Take the above materials in the 1:1:5 ratio and mix well using water. During this the mixture should be carefully searched for hard particles like small stones etc. A fine mixture is prepared so that earthen vessels can be molded out of it.

After preparing the mixture, three pots (matkas) shaped like a hollow spindle are molded of similar dimension- diameter 10 inches, height 1 foot and wall thickness 0.59 inch.

FIGURE 2 A MATKA FILTER



As illustrated in the figure, a hole is bored at the bottom of the first two pots and another hole on the side wall of the lowest pot to fit a tap in it. The top most pot is filled with iron contaminated water which passes through the middle pot and gets filtered. Iron free water trickles down to the lowest pot from where it can be drawn using the tap. The two pots on the top are molded with a 0.59 inch broad semi-circular mouth so that one sits perfectly on the other when placed on top. A lid is also molded for covering the top most pot. This completes the outer body of the matka filter and the entire setup comprises a single unit. The unit is left to dry for some time. After molding the filter units they are set in a kiln and baked in the fire.

Construction of kiln and baking process:

Materials required- Dried cow dung cakes (for fuel), paddy straw and clay.

Baking method- The molded pots are set in a kiln and covered with a paste of clay and paddy straw so that the heat from the fire spreads uniformly over the pots. The pots are fired in the kiln for two days and then removed. The lowest pot with a hole on the side wall is then fitted with a tap using cement. With this the outer body of the matka filter is ready.

2. Construction of other parts of matka filter

As illustrated in the Figure 2, the filtration component is constituted of three layers, each separated by a nylon mesh. A nylon mesh is placed inside the middle pot and two inch thick layer of fine sand is spread on it and the cloth is tied. The sand before being placed on the mesh is washed to remove clay and clay present in it. Another another nylon mesh is placed on the sand layer and a two inch layer of brick bat is placed over it and the mesh is tied. This is followed with a new nylon mesh and now a two inch thick layer of wood charcoal is spread on top and a similar approach is adopted with the mesh. The filtration medium is finally covered with a nylon mesh. This completes the filtration section of the matka filter.

This design developed by MPA has pots with a 10 inch diameter and wall thickness of 0.59 inch. The filter is 1 foot high and has a capacity of 15.69 liters.

How to use - Iron contaminated water in poured in the top most pot which gets filtered through the filtration medium placed in the middle pot. Iron free water gets collected in the lowest pot and is removed using the tap

.

Precaution-

i) The lid must be placed back in its position after filling the pot.
ii) The water should be removed from the lowest pot using the tap only.
iii) The filter should be placed at a higher position so that it is easy to remove water using the tap at the bottom.
iv) The materials used in the filter (sand, wood charcoal and chipped bricks) must be checked and cleaned to maintain the quality of water

TABLE 2

Raw Material	Cost of Raw Material (for 100 units of Matka Filter in Rs.)	Cost of Raw Material (for 1 unit in Rs.)
Clay	450 (for 1 trailer load, approx. 80 Cu. Ft.)	4.50
Sand	160 (for 16 Cu. Ft.)	1.60
Saw Dust	178 (for 16 Cu. Ft.)	1.78
Cow Dung Cakes	2,400	24.00
Wood Charcoal	990	9.90
Paddy Straw	750	7.50
Tap	3,000	30.00
Cement	6	0.06
Total	Rs. 7,934	Rs. 79.34

Labour costs involved are:

TABLE 3

Type of Worker	Nature of Work	Time Required for Producing 100 Units (in days)	Cost of Producing 100 Units (in Rs.)	Cost of Producing 1 Unit (in Rs.)
Artisan	Construction of matka filter	36	36X300= 10,800	108.00
Labourer	Construction of matka filter	36	36X150= 5,400	54.00
Artisan	Baking the pots	4	4X300= 1, 200	12.00
Labourer	Baking the pots	4	4X150= 600	6.00
Painter	Painting the pots		4,000	40.00
Total		40	Rs. 22,000	Rs. 220.00

Total expenditure for production of 100 units of matka filter:

TABLE 4

Cost Component	Expenditure for Production of 100 Units (in Rs.)	Expenditure for Production of 1 Unit (in Rs.)
Raw Material	7,934	79.34
Labour	22,000	220.00
Total	Rs. 29,934	Rs. 299.34

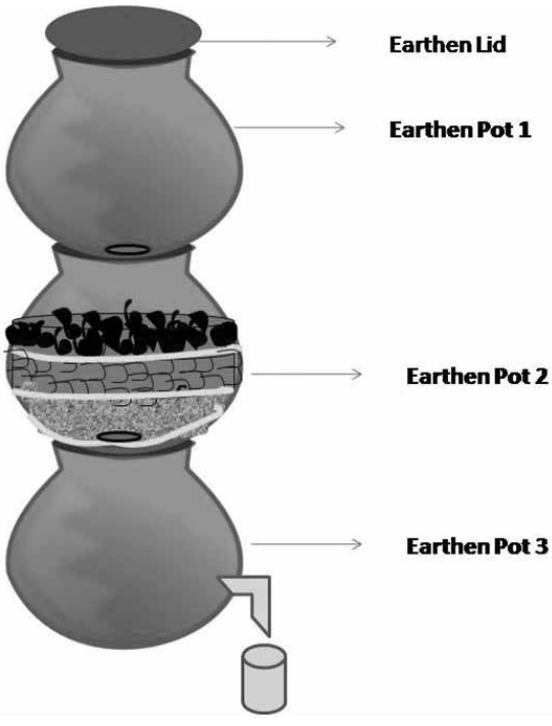
Percentage of cost component for production of 100 units of matka filter:

TABLE 5

Cost Component	Percentage for Production of 100 Units
Raw Material	26.50 %
Labour	73.50 %

As detailed above, the cost of producing one unit of matka filter of the stated dimensions is Rs. 300/- approximately. Apart from this design, MPA has also developed an overall pot shaped matkal filter with a diameter of 10 inch and capacity of 14.72 liters, for Rs. 150/-. The model which has been installed in the community is illustrated in the following figure.

FIGURE 1 MATKA FILTER



The technique for making pot shaped matka filter is similar to that of molding spindle shaped pots. The only difference is that for molding this only clay is mixed with sand in a 1:5 proportion (one part sand, five parts clay). From a trailer load of clay 500 pots of the dimension illustrated in Figure 3 can be made. This constitutes the outer body of the pot shaped matka filter.

The baking process is similar to that of the other matka filter. The fuel used in kiln is either dry cow dung cakes or firewood.

The cost of production of pot shaped matka filter is lesser than the regular matka filter. It is because this type of matka filter is made on potter's wheel and does not require coal to bake it

.

Cost of production of 150 units of pot shaped matka filter is as follows:

TABLE 6

Raw Material	Cost of Raw Material (for 150 units of Matka Filter in Rs.)	Cost of Raw Material (for 1 unit in Rs.)
Clay	780 (for 1 trailer load, approx. 80 Cu. Ft.)	5.20
Sand	40 (for 16 Cu. Ft.)	0.27
Cow Dung Cakes	650	4.33
Paddy Straw	450	3.00
Firewood	450 (15 head loads of Rs. 30 each)	4.00
Tap	4,500	30.00
Cement	9.00	0.06
Total	**Rs. 7,029**	**Rs. 46.86**

Labour costs involved in producing 150 units of pot shaped matka filter:

TABLE 7

Type of Worker	Nature of Work	Time Required for Producing 150 Units (in days)	Cost of Producing 150 Units (in Rs.)	Cost of Producing 1 Unit (in Rs.)
Artisan	Construction of matka filter	17	17X300= 5,100	34.00
Labourer	Construction of matka filter	17	17X150= 2,550	17.00
Artisan	Baking the pots	4	4X300= 1, 200	8.00
Labourer	Baking the pots	4	4X150= 600	4.00
Painter	Painting the pots	6,000	40.00	
Total		**42**	**15,450**	**103.00**

Total expenditure for production of 150 units of pot shaped matka filter:

TABLE 8

Cost Component	Expenditure for Production of 150 Units (in Rs.)	Expenditure for Production of 1 Unit (in Rs.)
Raw Material	7,029	46.86
Labour	15,450	103.00
Total	**Rs. 22,479**	**Rs. 149.86**

Percentage of cost component for production of 150 units of pot shaped matka filter:

TABLE 9

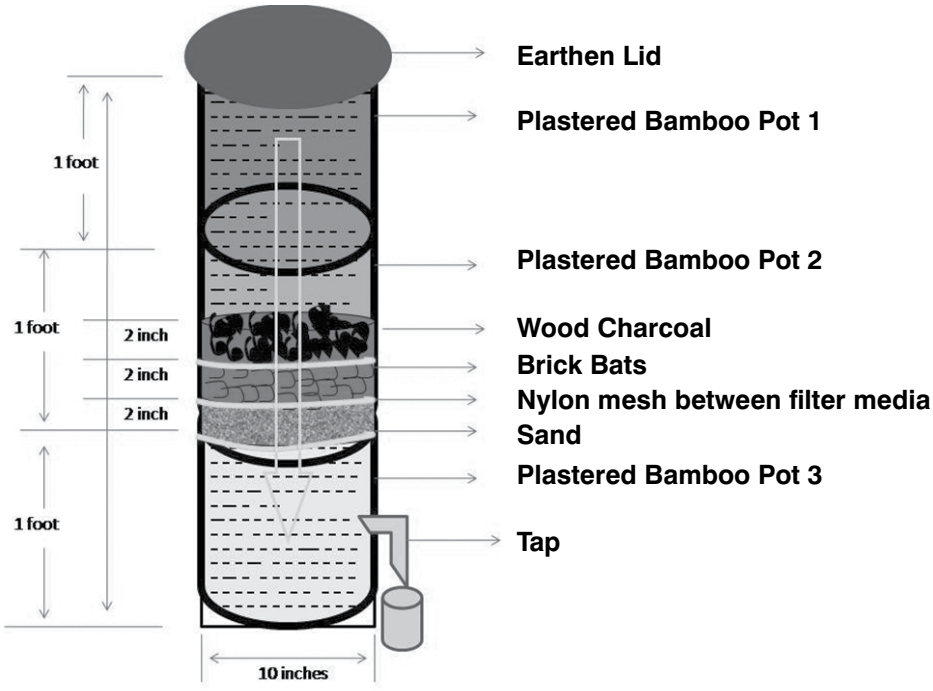
Cost Component	Percentage for Production of 150 Units
Raw Material	31.27 %
Labour	68.73 %

Advantages of matka filter:

1. It is made from locally available materials.
2. It is inexpensive.
3. Production and use of this filter also provides employment to potters.
4. Due to the transpiration from the earthen material of the filters, the water stored in it remains cool.
5. This filter is an indigenous solution to obtain iron free drinking water.
6. The percentage of cost components in Table 9 shows that the production of these filters can be done under schemes like MNREGA which benefits the community as well.

Apart from the two designs described above, MPA has also designed a matka filter made of bamboo based on people's requirement and convenience.

FIGURE 4 MATKA FILTER MADE OF BAMBOO



The hollow spindle like design of the bamboo matka filter is similar to the regular matka filter. The arrangement and working is also similar. The containers made of bamboo are plastered with a layer of cement and sand mixed in 1:3 proportions. After this the entire body is painted. The dimensions of this filter are- inner diameter of 10 inches, height 1 foot 2 inches and has a capacity of 24 liters. The cost of production of this filter is Rs. 550/-.

Cost of production of 100 units of bamboo matka filter is as follows:

TABLE 10

Raw Material	Cost of Raw Material (for 100 units in Rs.)	Cost of Raw Material (for 1 unit in Rs.)
Bamboo	8,000	80.00
Sand	2,175 (for 145 Cu. Ft.)	21.75
Tap	2,000 (20X100)	20.00
Cement	12,245 (1975 kg)	122.45
Paint	4,000	40.00
Water proof powder	200	2.00
Cement paning	2,789 (4 bags)	27.90
Total	**Rs. 31,410**	**Rs. 314.10**

Labour costs involved in producing 100 units of bamboo matka filter:

TABLE 11

Type of Worker	Nature of Work	Time Required for Producing 100 Units (in days)	Cost of Producing 100 Units (in Rs.)	Cost of Producing 1 Unit (in Rs.)
Bamboo Craftsman	Shaping bamboo filter containers	50	250X50= 12,500	125.00
Mason matka filters	Plastering bamboo	25	250X25= 6,250	62.50
Labourer	Plastering bamboo matka filter	25	25X150= 3, 750	37.50
Painter	Painting bamboo matka filter	10	10X150= 1,500	15.00
Total		**110**	**24,000**	**240.00**

Total expenditure for production of 100 units of bamboo matka filter:

TABLE 12

Cost Component	Expenditure for Production of 100 Units (in Rs.)	Expenditure for Production of 1 Unit (in Rs.)
Raw Material	31,410	314.10
Labour	24,000	240.00
Total	**Rs. 55,410**	**Rs. 554.10**

Advantages of bamboo matka filter:

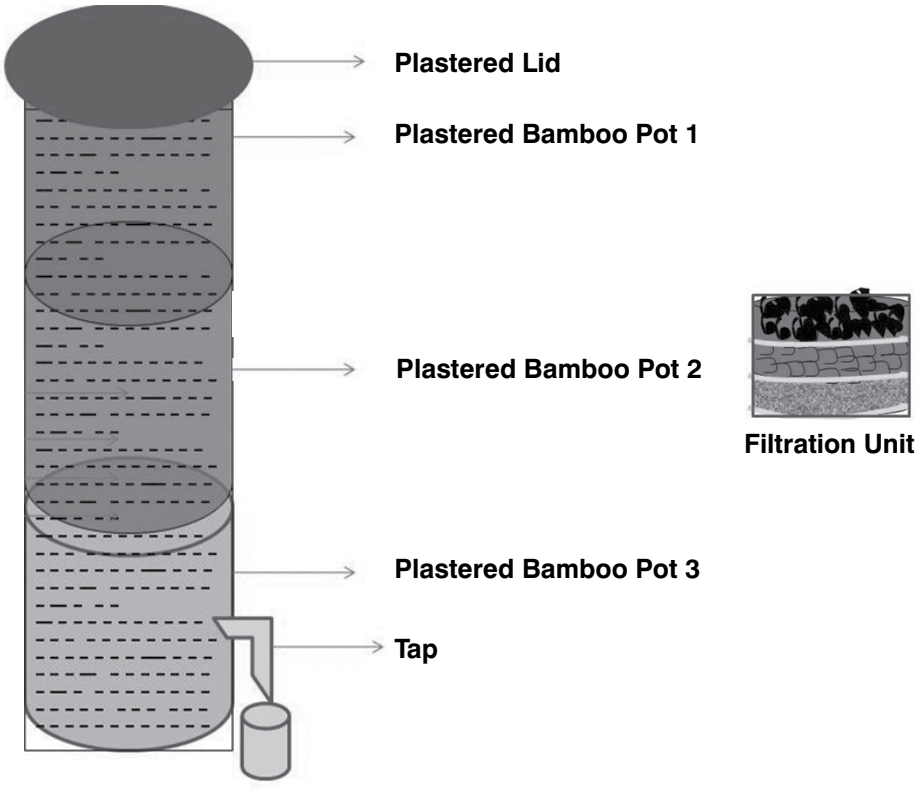
1. Higher durability.
2. Storage capacity of this filter is higher than regular matka filter.
3. Locally prepared by using local skill sets

Matka filter cum jal kothi

Another use of bamboo matka filter is to harvest and store rain-water. MPA has been exploring a dual purpose bamboo matka filter design for flood prone regions, where this filter can be used to harvest rain water during rainy season and function as a regular filter during other times. This design has been developed in a similar way as other matka filter designs. The filtration unit is also similar and has a multi layered arrangement. The middle container contains two separators between which the filtration unit is fitted. During rainy season when the bamboo

matka filter is to be used for harvesting rain water, the filtration unit is simply removed from the separators and the entire unit becomes a single enlarged container for storing rain water. This design is called Jal Kothi.

FIGURE 5 A MATKA FILTER WITH REMOVABLE FILTER UNIT



Cost of production of 100 units of jal kothi is:

TABLE 13

Raw Material	Cost of Raw Material (for 100 units of Matka Filter in Rs.)	Cost of Raw Material (for 1 unit in Rs.)
Bamboo	12,000 (Cost of a bamboo stalk- Rs. 80, construction of 1 jal kothi requires 1.5 bamboo stalks)	120.00
Sand	3,000 (for 200 Cu. Ft.)	30.00
Water proof cement	15,500 (50 bags)	155.0
Metal ring	501	5.01
Tap	2,000	20.00
Cement paint	2,000	20.00
Total	**Rs. 35,001**	**Rs. 350.01**

Labour costs involved in producing 100 units of jal kothi:

TABLE 14

Type of Worker	Nature of Work	Time Required for Producing 100 Units (in days)	Cost of Producing 100 Units (in Rs.)	Cost of Producing 1 Unit (in Rs.)
Bamboo craftsman	Construction of outer body of jal kothi	150	150X250= 37,500	375.00
Mason	Plastering jal kothi	27	27X250= 6,750	67.50
Labourer	Construction and plastering jal kothi	40	40X150= 6, 000	60.00
Painter	Painting jal kothi	10	10X150= 1,500	15.00
Total		**227**	**51,750**	**517.00**

Total expenditure for production of 100 units of jal kothi:

TABLE 15

Cost Component	Expenditure for Production of 100 Units (in Rs.)	Expenditure for Production of 1 Unit (in Rs.)
Raw Material	35,001	350.01
Labour	51,750	517.50
Total	Rs. 86,751	Rs. 867.51

Percentage of cost component for production of 100 units of jal kothi:

TABLE 16

Cost Component	Percentage for Production of 100 Units
Raw Material	40.35 %
Labour	59.65 %

Advantages of bamboo matka filter:

1. Higher durability
2. Two different usage from one structure
3. Locally prepared by using local skill sets

Outcome of the initiative

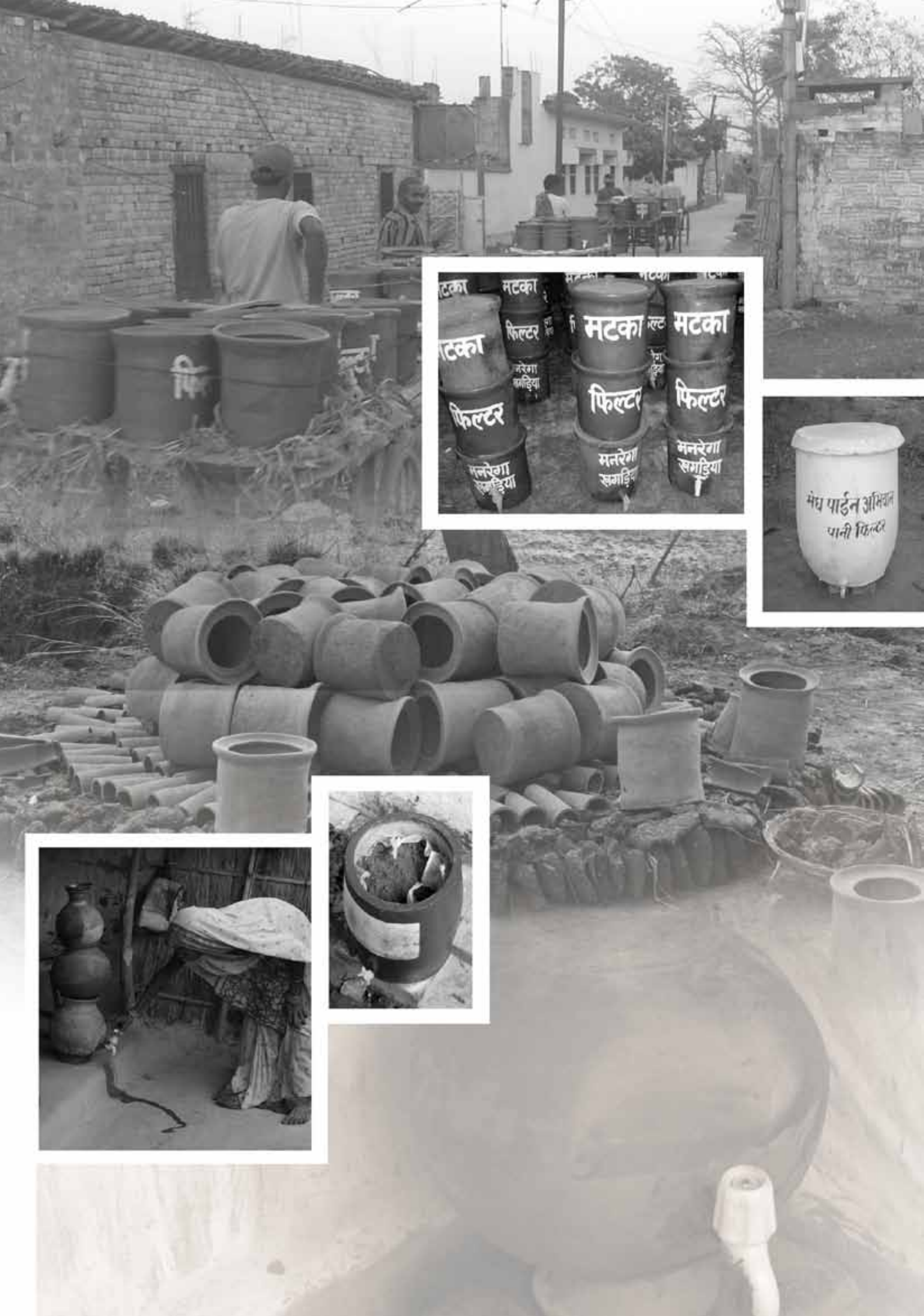
The increasing demand for individual matka filters is an indicator of the local acceptance of the remodeled version of the filter. On assessing the demand, the campaign decided to further streamline the production of matka filters by adopting a business model, where the capacity of the local potters will be enhanced for ensuring quality product and its longevity.

Installation of matka filter in schools and play schools has generated consciousness within the rural households. As a future strategy, the intervention in these two sites will be further intensified. The effort will be to explain the functioning and benefits of the filter to the students depending upon their extent of comprehension.

The inclusive approach of the campaign was responsible for the introduction and acceptance of the filter in areas where the technique was either not present nor popular.

The local experience of accessing safe water during floods provided confidence to people to accept yet an alternative technology.

Demand for matka filters has provided the local potters with an opportunity to strengthen their traditional livelihood practice.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फिल्टर
मनरेगा समाड़िया
मेघ पाईन अभियान
पानी फिल्टर

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Kosi Seva Sadan - Saharsa

Samta - Khagaria

Ghoghardiha Prakhand Swarajya Vikas Sangh - Madhubani

Water Action - Pashchim Champaran

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