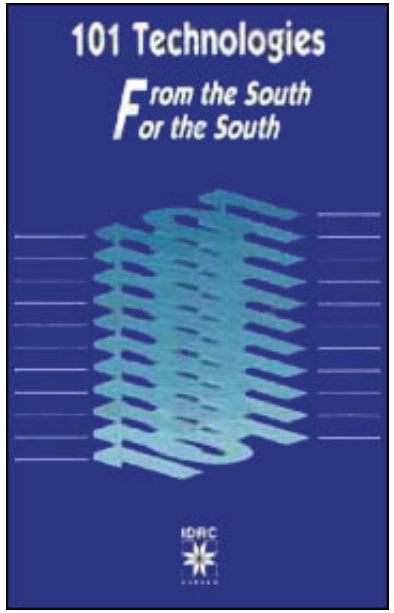

One Hundred and One Technologies - From the South for the South (IDRC, 1992, 231 p.)

Health

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One Hundred and One Technologies - From the South for the South (IDRC, 1992, 231 p.)

Health

60. Inexpensive blood-screening for HIV

The spread of AIDS through blood transfusion has largely been eliminated in the North through routine screening of blood supplies. However, in many countries of the South, there is a lack of resources and facilities to screen blood for the human immunodeficiency virus (HIV). In Africa, 5-10% of HIV infections occur through blood transfusions, which are very common. Freshly-donated blood is used to treat life-threatening anemia in children (common in areas where malaria is endemic). The lack of routine testing of donated blood is hampering efforts to prevent the spread of AIDS.

PATH Canada (Program for Appropriate Technology in Health) and PATH

International have developed a simple, rapid, and inexpensive test ideal for areas where sophisticated equipment and trained staff are not available to do the kind of HIV screening done in the North. The HIV ImmunoDot Test is a plastic dipstick in the shape of a comb (which allows the user to test up to eight samples at once) that is dipped into serum, plasma, or whole blood samples for 10 minutes. It is then rinsed and incubated for 10 minutes in a reagent solution. If HIV antibodies are present, a red dot appears at the end of the stick.

The method uses a synthetic peptide which is immobilized on the comb and which "captures" the HIV antibody. A solution of colloidal gold conjugated to protein A is used to produce the red dot.

The new process has the following advantages:

- **It is ideal for remote areas where only a small number of tests are done at one time (current tests are geared to high volumes);**
- **Electricity or special equipment not needed;**
- **Minimal training is required;**
- **The whole process takes about 20 minutes, as opposed to the 2-4 hours needed for conventional tests;**
- **The testing material doesn't require refrigeration, and will remain stable for up to a year at temperatures typical of equatorial Africa;**
- **The method costs US 50 cents or less per test, as opposed to current tests that**

cost at least US $2, and sometimes as much as US $7.

Laboratory trials in Canada, the US, and Europe, and field trials in Brazil, China, Kenya, Thailand, and Uganda confirm that the new test performs as well as the best available commercial screening tests and has a sensitivity (ability to detect antibodies) approaching 100% and a specificity (ability to detect the absence of antibodies) of 98%. The test can be used to detect antibodies to the HIV 1 virus. Work is currently underway to adapt the dipstick for combined HIV 1 and HIV 2 testing, as well as for the hepatitis B virus.

PATH itself does not commercially produce the test. It has prepared the documentation and master files necessary to transfer the know-how for manufacture to the public and private sectors in developing countries. Plans for local production of the test have begun in Brazil, Cameroon, China, Indonesia, and Zimbabwe, and it is hoped that the test will eventually be widely available throughout the South.

Potential users

Blood banks in developing countries, clinics in poor areas, bush hospitals, and other blood transfusion settings, especially in remote areas.

Cost and availability

The test is not being produced commercially in the North, but will become available through the public sector of countries in the South.

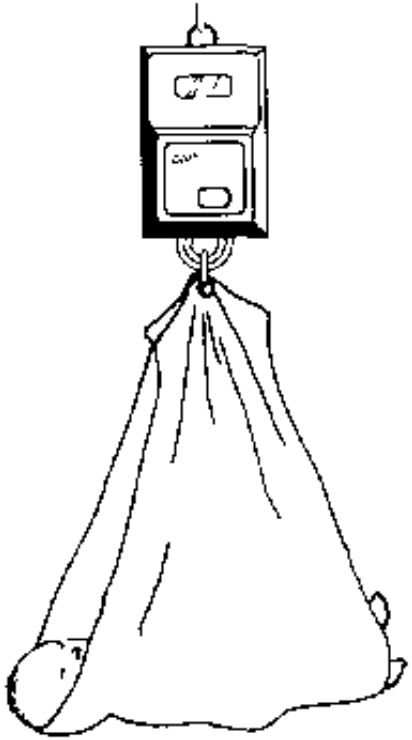
Contact

Dr Milton R. Tam PATH 4 Nickerson Street Seattle, WA, USA 98109-1699 Tel.: (206) 285-3500 Fax: (206) 285-6619 Telex: 4740049 PATH UI

NB: PATH is not a supplier of the test. It is assisting countries of the South with local production.

61. Solar-powered infant scale

Monitoring children's growth is generally accepted as one practical way to assess their general health and nutrition. Children who are seen to have poor growth can be targeted by health workers for special attention. In developing countries, community-based child-weighing programs are an integral part of community health strategies. A variety of weighing scales is used, from simple spring scales and locally made balances to heavy-duty hospital balances. However, most of these devices lack one or several important characteristics such as low cost, ease of use, portability, high accuracy, and durability.



Children

In response to the need for an appropriate scale for field use, Sensor International Inc., - a joint venture between the Program for Appropriate Technology in Health (PATH) and Masstech Inc., an Australian corporation - has developed the electronic Sensor Scale. An earlier prototype scale, called PATHweigh, was a battery-operated hanging scale developed by PATH and field-tested in Bangladesh and Indonesia in 1985. The new version, the Sensor Scale, is a solar-powered electronic scale that provides a digital display of the weight in 100-gram increments. It was developed in a stand-on version and a hanging version. Prototypes of the stand-on Sensor Scale were field-tested in 1989 by UNICEF in ten countries. The trials showed the scales to be easy to use and widely acceptable to health workers.

The prototype electronic Sensor Scale has the following features:

- **It is compact and lightweight;**
- **It provides an easy-to-read digital display;**
- **The hanging scale can weigh up to 45 kg (children up to 5 years);**
- **It is accurate within 100 grams;**
- **It reduces operator error by automatically taking into account the weight of the person or container holding the child;**
- **The scale offsets errors due to the child's movements by averaging weights and providing one final reading;**
- **It displays the weight in 100-gram increments, making reading and recording the weights easier;**
- **The scale is solar-powered;**
- **It can operate at high temperatures and humidity levels;**
- **It is durable; and**
- **It will shut off automatically after 5-10 minutes, if not in use.**

Potential users

Primary health care workers in rural areas (the scale is very portable) and health clinics.

Cost and availability

Public-sector developing country rights are held by UNICEF. Large-scale production of the stand-on version is proceeding, and it is expected that the scales will be available in mid-1993 through the UNICEF Copenhagen warehouse. A rough estimate of the price is US $95.

Contact

Program for Appropriate Technology in Health (PATH) 4 Nickerson St, Seattle, Washington, USA 98109-1699 Tel.: (206) 285-3500; Fax: (206) 285-6619 Telex: 4740019 PATH UI; Cable: PATH

PATH can also be contacted at the following addresses:

37 Petchburi 15 (Soi Somprasong 3) Petchburi Road, Bangkok 10400, Thailand Tel.: (662) 251-7338-9; Fax: (662) 253-9171 Telex: 788 20327 PRPRTY TH

PO Box 57046, Ole Odume Road, #30, Nairobi, Kenya Tel.: (2542) 566714; Fax: (2642) 566714

Tifa Building 11th Floor, Suite 1102 Jl. Kuningan Barat No.26, Jakarta, Indonesia Tel.: (6221) 5200737; Fax: (6221) 520-0621 Telex: 79662851 TIFA IA

62. Hand-held scale for identifying low weight newborns

Millions of underweight infants are born each year. These babies are at increased risk of illness and death and need special care to survive. Midwives and traditional birth attendants must be able to identify which newborns are in need of special care.

The Program for Appropriate Technology in Health (PATH) has developed a simple scale for use by midwives to identify babies with a dangerously low birth weight. The scale, called BIRTHweigh, is a stainless steel spring scale which is colour-coded, inexpensive and portable. The scale is held by hand and a 100-gram cloth sling is suspended from it. If the small window on the scale has yellow showing, the child weighs less than 2500 grams and needs special care. If the window is entirely blue, the child weighs more than 2500 grams. Weight less than 2600 grams is considered to be the international standard for low birth weight.

The scale is accurate to within 100 grams. In field trials in Egypt, Malawi, and Yemen. the scale was shown to be durable and very well accepted by its users. It can withstand 10 kg of overweight without any serious distortion.

Potential users

Midwives, nurses, and other birth attendants.

Cost and availability

The scales are currently being produced locally in Egypt and Malawi, and are in use in Bolivia, Guatemala, Yemen, Pakistan, and Zambia. Scales and slings can be ordered directly from the UNICEF Copenhagen warehouse catalogue by NGOs, governmental agencies, and UN agencies, for approximately US $4.50. Small

orders of scales and patterns to make the slings locally can be coordinated through PATH.

Contact

Program for Appropriate Technology in Health (PATH) 4 Nickerson Street, Seattle, Washington, USA 98109 Tel.: (206) 285-3500; Fax: (206) 285-6619; Telex: 4740049 PATH UI

Director, Supply Division, UNICEF
UNICEF Plads
DK-2100, Copenhagen, Denmark
Tel.: 45-31-26-24-26; Fax: 45-31-26-94-21;
Telex: 19813

Other addresses for PATH:

37 Petchhuri 15 (Soi Somprasong 3) Petchburi Road, Bangkok 10400, Thailand Tel.: (662) 251-7338-9; Fax: (662) 253-9171 Telex: 788 20327 PRPRTY TH

PO Box 57046 Ole Odume Road, #30, Nairobi, Kenya Tel.: (2542) 566714; Fax: (2542) 566714

Tifa Building 11th Floor, Suite 1102 Jl. Kuningan Barat No. 26, Jakarta, Indonesia Tel.: (6221) 5200737; Fax: (6221) 520-0621 Telex: 79662851 TIFA IA

63. Colour-coded test strips for detecting urinary protein

The detection of protein in urine, called proteinuria, is a method used to identify several medical problems, including schistosomiasis, urinary tract infection, and renal disease. Although accurate test strips for urinary protein exist, they are often too expensive for Third World health programs and must be imported.

Figure

The Program for Appropriate Technology in Health (PATH), has developed inexpensive, accurate test strips for use by health workers with minimal training. Called PATHstrips, these tests are durable, easy to use, and able to withstand tropical conditions.

PATHstrips are supplied in a tear-off form in boxes of 50 strips each. After the strip is dipped in urine, its colour is compared to a reference chart printed on the box.

Independant tests have shown the strips to be as accurate as other available

proteinuria tests. They have been fieldtested in Malawi, Yemen, and Zambia.

Potential users

Laboratory technicians, health clinic staff, and community-based health workers.

Cost and availability

PATH has provided production equipment and technical assistance for the production of the strips to Central African Pharmaceutical Suppliers (CAPS) in Harare, Zimbabwe. A subsidiary of CAPS, McDonald Scientific (Pvt) Limited, is currently producing the strips, at a price of US $1.25 for a pack of 50 tests. CAPS also intends to distribute the strips through the UNICEF Copenhagen warehouse catalogue.

Contact

McDonald Scientific (Pvt) Ltd PO Box 3590, Msasa, Harare, Zimbabwe Tel.: (263-4) 48191/48101; Telex: 24224 MMDS ZW; Cable: McDent; Fax: (263-4) 48196

PATHstrips will be available through UNICEF, beginning in 1992.

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Telex: 19813

64. Equipment and training packages for health workers

The Centro de Investigaciones Multidisciplinarias en Desarrollo Rural (CIMDER) has developed a health care package consisting of simple and innovative materials and equipment for primary health care workers.

The package contains the following items:

- **Tricoloured tape for measuring arm circumference identifies malnourished children and acts as a guide in assessing the health of children. The tape has also spurred community groups to improve community health services and to work on improving health and nutrition by forming cooperatives to increase crop production. Women particularly like the tape as it allows them to identify for themselves the nutritional state of their children.**

- **Microlab for diagnosis of simple ailments. The microlab contains such elements as microstix for urine cultures and analysis, sterile bags, etc.**

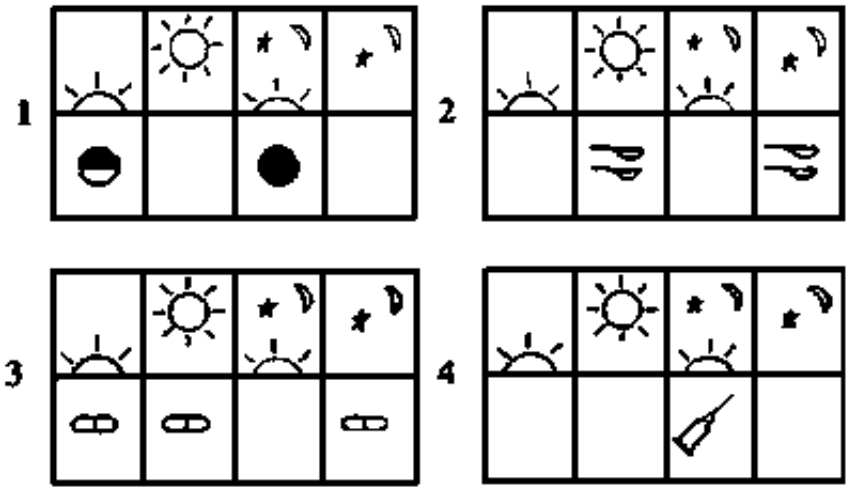
- **Microhealth post, with first-aid equipment and drugs for common illnesses, enables primary health care workers to manage 60% of the illnesses they encounter.**

- **Master file, with its colour-card information system, allows the health worker to assess the health of the community, and includes a health flag to inform the community of its progress.**

- **Other components consist of a backpack; a well chlorinator for small wells and water tanks; and manuals on primary health care, maternity and child care,**

sanitation, community organizing, and immunization.

CIMDER, which designs, implements, and evaluates health technologies and programs (primary health care, social participation in health, health education, the management of health centres and institutions) emphasizes strong community organization and participation in its own health processes through training programs for family leaders, rural volunteers, community workers, and health promoters. For example, mothers receive training that enables them to practice effective health care at home, to increase their knowledge in informal community settings, and to assume an active role in community health care activities.



Circles

CIMDER is becoming a reference centre for other Latin American countries - including Bolivia, Ecuador, Guyana and Paraguay - are interested in adopting this health care model. The Colombian government has replicated parts of this model in other regions of the country.

Prerequisites Training in the use of CIMDER's approach and technologies.

Potential users

Community leaders, community health workers, volunteers, health officers, NGOs, government, and others involved in health care delivery in Latin America. Materials could be translated and adapted for use in other countries.

The health kit is available to interested groups and NGOs, for a cost of approximately Can $42. CIMDER is interested in sharing its experience with other institutions.

Contact

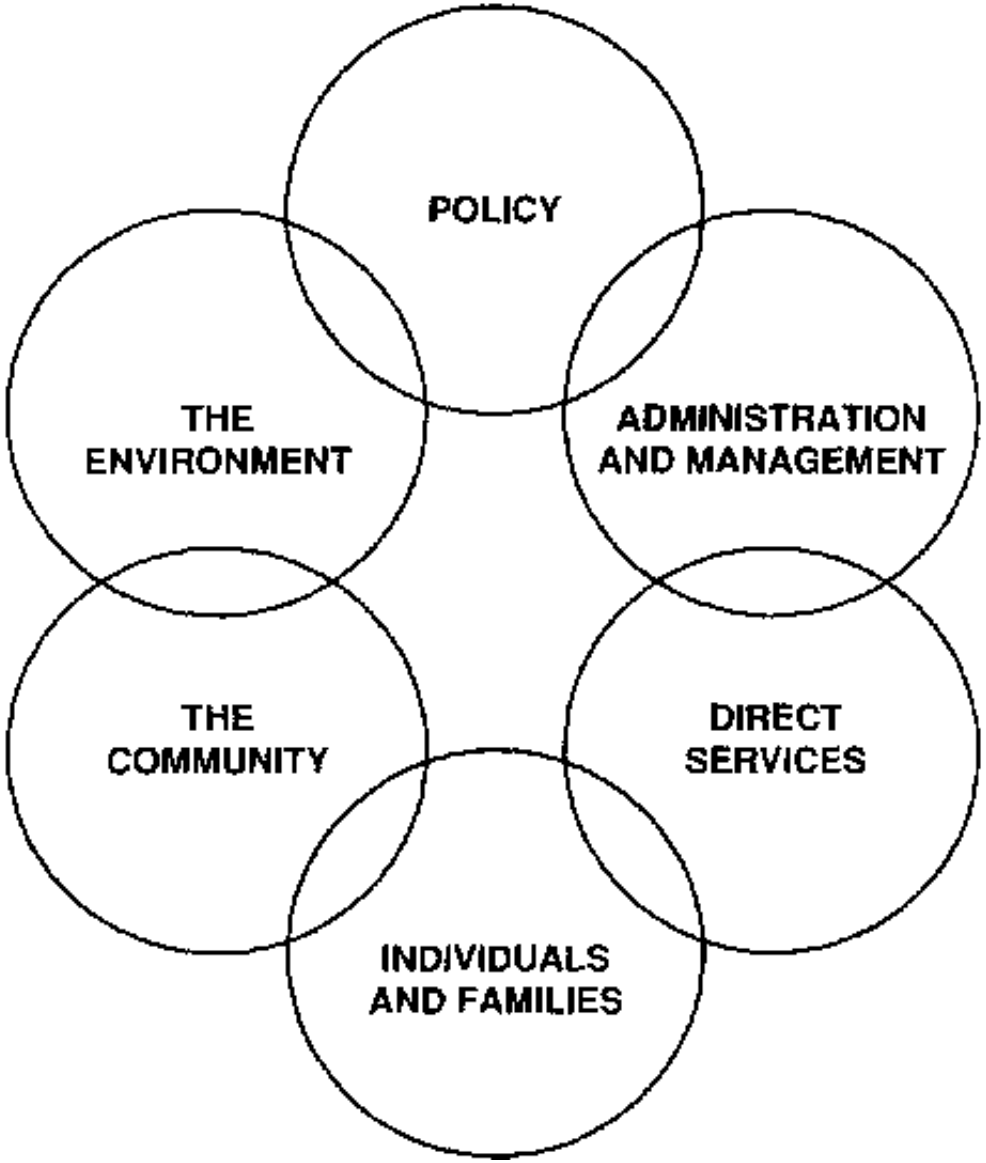
Ligia Malagon de Salazar, Director, CIMDER Universidad del Valle, Facultad de Salud AA 3708, Cali, Colombia Tel.: (57-23) 56.45.05; Fax: (57-23) 56.25.75; Cable: 4B # 36-00

Resources and publications

CIMDER has produced handbooks in Spanish on basic health care, administration of health care centres, and guides for the primary health care worker and for the use of the micro health post. They have also published a book for women on health care in the home and in the community entitled Escuela de Madres para el Autocuidado de la Salud Familiary Comunitaria, as well as other publications on health issues. These and software for the management of health institutions are available to interested groups.

65. Training materials in health systems research

Health services in developing countries are undergoing many changes to improve accessibility to quality services and to encourage effective community participation in the promotion and maintenance of good health. Countries are constantly having to decide on the best approaches to take in terms of planning and policy, administration of health services, financing, and appropriate technologies. They need detailed and accurate information on needs' possibilities, and the consequences of proposed actions to make effective decisions.



Areas of major concern in the health system.

Health systems research (HSR) aims to improve the health of a community by enhancing the health system, which is seen as an integral part of the overall socioeconomic development process. HSR seeks to provide community leaders,

health workers, and managers at all levels with the information they need to make good decisions.

The main characteristics of HSR are:

- **It focuses on priority health problems;**
- **It is participatory in nature;**
- **It is action-oriented;**
- **It is multidisciplinary;**
- **It is multisectoral;**
- **It emphasizes cost-effectiveness;**
- **It seeks to provide practical, timely solutions;**
- **It evaluates proposed changes.**

After some years of sponsoring workshops on health services/health systems research in developing countries, IDRC, along with the World Health Organization, decided to support the preparation of a set of training materials in HSR aimed at specific target groups. The result is a five-volume set of publications, aimed at five target groups.

The first addresses the need to promote the use of HSR as a management tool among decision-makers. Based on an analysis of experience in developing countries over the last 10 years, it provides an overview of how HSR can lead to better decisions, as well as information on how to foster effective research programs at a country level. It also includes descriptions of specific strategies for promoting HSR among policymakers and senior managers.

The second volume, in two parts, is the core course, presented in a modular format. Part I covers the development of research proposals of a participatory nature and the implementation of a field study. Course participants select a priority health problem that cannot be solved without additional information, then carry out the planned research as a team. Part II deals with data analysis and the dissemination of results.

The third volume is a review of strategies to assist universities and research institutes to integrate HSR concepts into health and social sciences degree programs. It includes important guidance for those in the research community who want to involve their institutions in multidisciplinary HSR programs.

The fourth volume is a course outline in a modular format for managers of health systems research programs. It includes topics such as the processing of research applications, funding and coordinating research projects, and utilizing research results.

The fifth volume is also a course outline in a modular format to assist those who organize and conduct training in HSR. Intended for short courses, it contains 15 modules on the basic concepts of HSR, educational methods and training strategies. The teaching methods outlined have general application for training health staff in a variety of topics.

Users of the manuals are encouraged to look at the materials critically, and to choose and adapt whatever elements fit their needs. The course outlines are meant to be used in a flexible manner, with the trainer adapting the scheduling, sequence of modules, and content to fit the needs of the participants.

Potential users

Policymakers, health care managers, health workers, researchers and research managers, trainers and facilitators in health systems research.

Cost and availability

Each volume costs Can $12.95 with the exception of volume 2 which is priced at Can $19.95. All volumes are available free of charge to developing countries. The five volumes will be published in Spanish in 1992-93, followed by French versions. To order publications (see list below) write to IDRC's Corporate Affairs and Initiatives Division.

Contact

Coorporate Affairs and Initiatives Division
Marketing and Distribution
International Development Research Centre
PO Box 8500, Ottawa, Ontario, Canada K1G 3H9
Tel.: (613) 236-6163; Fax: (613) 238-7230
Telex: 063-3753; Cable: RECENTRE OTTAWA

For further information on the project, contact the Health Sciences Division, International Development Research Centre, at the address above.

Resources and publications

- **Promoting Health Systems Research as a Management Tool: Vol. 1; for Decision-**

Makers, Ann Brownlee, IDRC, 1991, $12.95.

- **Designing and Conducting Health Systems Research Projects: Vol. 2: Part I: Proposal Development and Fieldwork, and Part II: Data Analysis and Report Writing, Corlian M. Varkevisser, Indra Pathmanathan, Ann Brownlee, IDRC, 1991, $12.95 each or both for $19.95.**

- **Strategies for Involving Universities and Research Institutes in Health Systems Research. Vol.**
3, Ann Brownlee, Lilia Duran Gonzales, Indra Pathmanathan, IDRC, 1992, $12.95.

- **Managing Health Systems Research: Vol. 4, Indra Pathmanathan, IDRC, 1992, $12.95.**

- **Training of Trainers for Health Systems Research: Vol. 5: For Trainers and Facilitators, Indra Pathmanathan, N.I. Nik-Safiah, IDRC, 1991, $12.95.**

66. Poisons information package

The World Health Organization (WHO) through the International Programme on Chemical Safety (IPCS) in collaboration with the Canadian Centre for Occupational Health and Safety (CCOHS) and the Centre de toxicologic du Qubec (CTQ), and with the participation of poisons information centres around the world, has developed a poisons information package for developing countries.

Every year around the world, 100 million tonnes of chemicals are produced; 4000 industrial chemicals are currently in common use. Some 565 generic pesticides are in circulation, and account for 1 million poisoning cases each year, of which 40

000 cases in the Third World are fatal. Poison information centres are springing up all over the Third World, but lack the necessary technology to handle the data or simply don't have access to the information they need.

The package consists of two parts:

- **A global database of information on substances that are commonly involved in cases of poisoning; and**

- **A database management software program, called IPCS/INTOX, for poison information centres.**

The global database is an internationally-compiled bank of information on toxic substances. The information is packaged in the form of poisons information monographs (PIMs), which give detailed information on the physicochemical and toxicological properties of substances including chemicals, pharmaceuticals, and plant and animal poisons, as well as information on how to diagnose, manage, and prevent poisoning by these substances. PIMs are available in English, French, and Spanish in hard copy or on compact disc read only memory (CD/ROM).

The software program allows each poison centre to develop two interrelated databases, according to their own needs. The first is a database of substances and products; the second is a communications database to record cases and treatments.

The software is available in English, French, and Spanish. System manuals and user guides in English, French and Spanish are planned.

The package will be in use in mid-1992 by poisons information centres in Algeria, Egypt, Sri Lanka, Uruguay, the Philippines, and Zimbabwe. CCOHS will provide training, follow-up, and maintenance on a fee-for-service basis.

Prerequisites

The software package requires a 286 or 386 compatible microcomputer. Best performance is achieved with a 386 running at 20 Mhz or greater, with 4 Mb of RAM and a 80-Mb hard disk. It also requires a "super VGA" video card and a VGA colour monitor for the presentation of pictures with optimum clarity. A DOS 5.0 or higher operating system is recommended, along with Windows 3.0 or higher and a suitable mouse. A CD/ROM player is needed to access the database of PIMs and other material.

Potential users

Poison information centres in developing countries, as well as doctors, nurses, pharmacists, and other professionals such as firemen, police, and first-aid workers who deal with poisonings or accidents involving chemicals.

Cost and availability

The package will be issued by WHO on behalf of the project partners. WHO will hold the copyright.

Contact

Dr John Haines

International Programme on Chemical Safety
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World Health Organization
1211 Geneva 27, Switzerland
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67. Improved housing to fight the spread of chagas' disease

Chagas' disease is one of the more serious diseases in Latin America, with some 15 to 20 million people infected, 10% of whom will develop chronic Chagas' disease. The disease has an asymptomatic acute phase right after infection, and a chronic phase that only appears 15 to 20 years later. The chronic phase affects the heart, oesophagus, lower intestine, and peripheral nervous system.

The disease occurs mainly in rural areas, but is spreading to the cities through rural migration and through blood transfusions. The loss of work productivity is important, and rural migrants to cities can be refused employment if they are infected.

The disease is caused by a parasite (Trypanosoma cruzi), which is transmitted by the blood-sucking insect Triatoma infestans. The insects infest and breed in cracks in the walls of homes, in thatched roofs, and in cracks and spaces between wooden boards. They thrive in dark, poorly ventilated, humid environments. They also live behind furniture and wall hangings as well as in chicken coops and other animal shelters. Animal reservoirs of the vector are also common.

Because of the absence of effective drugs or vaccines, the disease must be controlled through preventive measures, such as controlling the vector insects inside people's houses. In Paraguay, a research team has studied the effects of two types of intervention in rural areas:

- **Spraying, using the insecticide Deltametrine; and**
- **Housing improvements to create a hostile environment for the insects.**

The housing improvements consist of modifying the existing structures in each house using improved materials to ensure smooth, flat, crack-free inside and outside walls and ceilings. Four main methods are used:

- **Plastering the walls and filling the joints between wood boards;**
- **Smoothing the roof and ceiling;**
- **Using light-coloured paint on the walls to help in the detection of insects;**
- **Improving ventilation and light through better doors and windows.**

Some examples of effective techniques used for housing improvement include:

Plastering and painting brick walls; plastering adobe and wattle walls using nails or small twigs to hold the plaster;

- **Using bamboo cane as supports for the ceiling, which is then plastered with a cement and soil mixture;**

- **Finding the best natural locally-available additives to add to paint (such as cactus juice) to prevent cracking;**

- **Finding the best plaster combinations and proportions (cement, sand and lime) to prevent cracking;**

- **Incorporating a window in the kitchen for the smoke to escape; bamboo canes in a netlike structure in the window can keep insects out while letting smoke escape;**

- **Mosquito netting can be used to keep insects out of the house.**

Most of the modifications can be done using locally available, low-cost materials.

The use of insecticides is a helpful and fast solution, but it can be too costly for rural people and is not permanent. However, it does provide 2-3 years of protection for the family while other interventions are being implemented.

The advantages of the housing improvements over building new houses are:

- **The improvements respect the original home, lifestyle, materials, and techniques of the inhabitants;**
- **Beauty and variety are maintained, and changes are more easily accepted;**
- **The value of the house increases; pride in their work increases the self-esteem of the inhabitants;**
- **New houses are often not adapted to the needs of the inhabitants.**

These interventions adapt and combine known technologies to solve a problem affecting both health and housing quality. Results of the research show that although the interventions can help reduce the incidence of Chagas' disease, they do not provide total control of the insect vectors. The key to their success is community involvement and cooperation from the outset. Because of the late onset of symptoms, Chagas' disease is not taken seriously by rural communities, who are more concerned with day-today survival than with a problem that will only emerge 15 to 20 years later. Strategies to combat the disease must be part of a holistic approach to community health, including interventions on such immediate concerns as maternal and child health and treatment of diarrhea and

other infections. They must be an integrated part of general development initiatives undertaken by the community and incorporate other community goals and cultural values.

Potential users

Communities and organizations working in the areas of health and housing throughout Latin America. In Paraguay, the idea has been "bought" by the Ministry of Health and the Council on Housing.

Cost and availability

During the course of the study, costs for housing improvements averaged US $12 per square metre, or about US $400 per house (not including the owner's labour). This is well below the national average cost for improved housing in Paraguay.

Contact

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Dr Antonieta Arias Instituto de Investigaciones en Ciencias de la Salud Rio de la Plata y la Gerenza Asuncin, Paraguay Tel.: 81312/82069/83618

68. A community-based approach to schistosomiasis control

Schistosomiasis affects more than 300 million people in Africa, Asia, and Central and South America. Another estimated 600 million are at risk from the debilitating

water-borne disease. The disease is caused by a tiny parasitic flatworm that lives part of its life-cycle in humans where it causes rashes, abdominal pain, fatigue, fever, and diarrhea as well as damage to the liver and spleen. The eggs of the worm are passed through urine and feces and hatch in water, where they live inside snail hosts. Once they become infectious, they leave the snail for water and infect humans through the skin.

Schistosomiasis impedes growth, school performance, and productivity, especially among women and children. It aggravates anemia, malnutrition, and parasitic diseases. Of Zimbabwe's 9 million people, it is estimated that more than 2 million suffer from schistosomiasis. In rural Zimbabwe, infection rates can be as high as 80%.

Drug treatment for the illness exists but people simply get reinfected when they come into contact with contaminated surface water: bathing, swimming, fishing, washing clothes, or simply crossing an infested river or stream. Chemicals used to kill the carrier snails are expensive, toxic, and provide only a short-term solution. The cost of both drugs and commercial molluscicides and the need to import them has meant that most countries have drastically reduced or abandoned their schistosomiasis control programs. As a result, prevalence of the disease is rising.

The Blair Research Laboratory (Ministry of Health), which developed the Blair Ventilated Improved Pit Latrine and the Blair series of PVC handpumps, has tested an integrated community-based program to control schistosomiasis within the primary health care system in two rural communities of Zimbabwe.

The program incorporated the following features:

- **Community sanitation and water programs were implemented, including latrine building, a hand-drilling rig for shallow wells, simple pumps, and slabs next to the pumps and wells for washing clothes.**

- **Health education activities were undertaken to increase awareness of the disease cycle and to encourage use of latrines, pumps, and washing slabs. Drama, an important part of local culture, was the most popular and effective educational tool, in the form of yearly school drama competitions on schistosomiasis and water and sanitation topics.**

- **Testing and treatment of infected people with the drug praziquantel was undertaken.**

- **Molluscicides were used to kill snails in nearby surface water.**

Research on the impact of these measures showed the potential viability of an integrated approach. Village women were involved in evaluating the pumps and latrines, and in describing changes in water contact habits. School children were tested on their knowledge of schistosomiasis and its transmission. Results of the research were fed back into the communities. A second evaluation phase has produced recommendations for a national control program, and highlighted the need for further research to develop molluscicides derived from local plant sources to kill the carrier snails.

Prerequisites

Community structures, involvement, and interest in an integrated effort; appropriate water and sanitation technology.

Potential users

This approach could be adapted in countries where schistosomiasis is endemic. Its practicability on a large (or national) scale is still under evaluation.

Contact

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Resources and publications

- **Community-Based Schistosomiasis Control in Zimbabwe, Final Report, Blair Research Laboratory and IDRC, 1989. A detailed and easy-to-read description of all aspects of the program.**

- **The Ministry of Health of Zimbabwe has developed easy-to-follow instructional materials on Blair pumps and on how to build Blair latrines, available from the Blair Research Laboratory at the above address.**

69. An environmentally friendly means of malaria control

Coconuts may provide a major boost in the battle against malaria. Coconuts are proving to be a simple, inexpensive medium in a new and economical way to check the spread of the disease. In 1988, malaria accounted for 2.5 million deaths and 489 million clinical cases in the Third World. The disease has been on the increase in recent years despite the wide use of chemical insecticides. These chemicals are expensive, have a short-term effect, are damaging to the environment, and pose additional health hazards to people.

Biological control of mosquitos has now become possible. Bacillus thuringiensis var. israelensis (Bti) is a spore-forming bacterium that produces a toxin lethal to mosquito larvae. It has been shown to be safe for people and the environment; Bti is now being produced commercially, but is expensive to import.

The Instituto de Medicina Tropical Alexander von Humboldt of the Universidad Peruana Cayetano Heredia (Peru) is devoted to research, training, and service in infectious and tropical diseases. The researchers have developed a new, simple, inexpensive method to produce Bti locally using coconuts. In many tropical areas, coconuts are both cheap and abundant. The coconut can be used as a medium for culturing Bti, which is then applied to ponds where malaria-transmitting mosquitos breed. The mosquito larvae eat the bacteria along with algae and are killed. Coconuts that have fallen naturally to the ground and may be unsuitable for eating can also be used to grow Bti.

The toxic strain of Bti fermented in coconuts, when applied in the field, kills virtually all the mosquito larvae and stops further larvae development for up to 45 days. A Bti kit, which requires minimal instruction, has been prepared for use by local people. Other techniques are being explored for use in areas where coconuts

are not plentiful.

The kit contains a plastic bag full of swabs doused in Bti and cotton plugs. The villager inserts one swab into each coconut through a hole drilled at the top and plugs it with cotton. After the coconuts have fermented 2-3 days depending on their size and the local temperature, the villager takes them to a nearby pond, breaks open the fruit over the water and throws it all in. A typical pond needs 2 to 3 coconuts for one treatment.

In a second phase, the project is focusing on the active participation of the community through a comprehensive education program. The kit offers the advantages of low cost, sustainability, and the use of a local resource to combat malaria.

Prerequisites

Preparation of Bti kit for field coconut inoculation: microbiologist and technician; culture medium; 2-litre fermenter; Bti H-14 strain. Production time required: 72-96 hours. Quality-control period: 24 hours.

- **Proper use of Bti kit in the field: trained local people; dependable source of coconuts; small bench area for preparation of kits; educational efforts for community sensitization and dissemination of technique; distribution system for Bti kits and for inoculated coconuts.**

Potential users

Combined with a major educational effort, this technique can be used by rural

people in any area where malaria is endemic and coconuts are plentiful.

Contact

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70. Fertilizer- producing no-pit latrine

Fecal contamination is a major contributor to mortality among children. The double-vault dry alkaline fertilizer family (DAFF) latrine was adapted from the successful Vietnamese double-vault latrine by the Centro Mesoamericano de Estudios sobre Tecnologa Apropiada (CEMAT) in Guatemala. The Guatemalans call them LASF: letrinas aboneras secas familiares.

Besides contributing to an improvement in health by breaking the cycle of fecal contamination and the spread of diseases such as diarrhea, hepatitis, typhoid, and parasitic infections, the DAFF latrine also provides farmers with fertilizer for their crops. This economic incentive has provided a major breakthrough for CEMAT in overcoming resistance to latrine use by the rural population, who believe that defecating in the fields improves the soil's fertility. The high-quality organic fertilizer produced by the DAFF latrine reduces farmers' costs and helps to avoid the long-term environmental problems caused by chemical fertilizers.

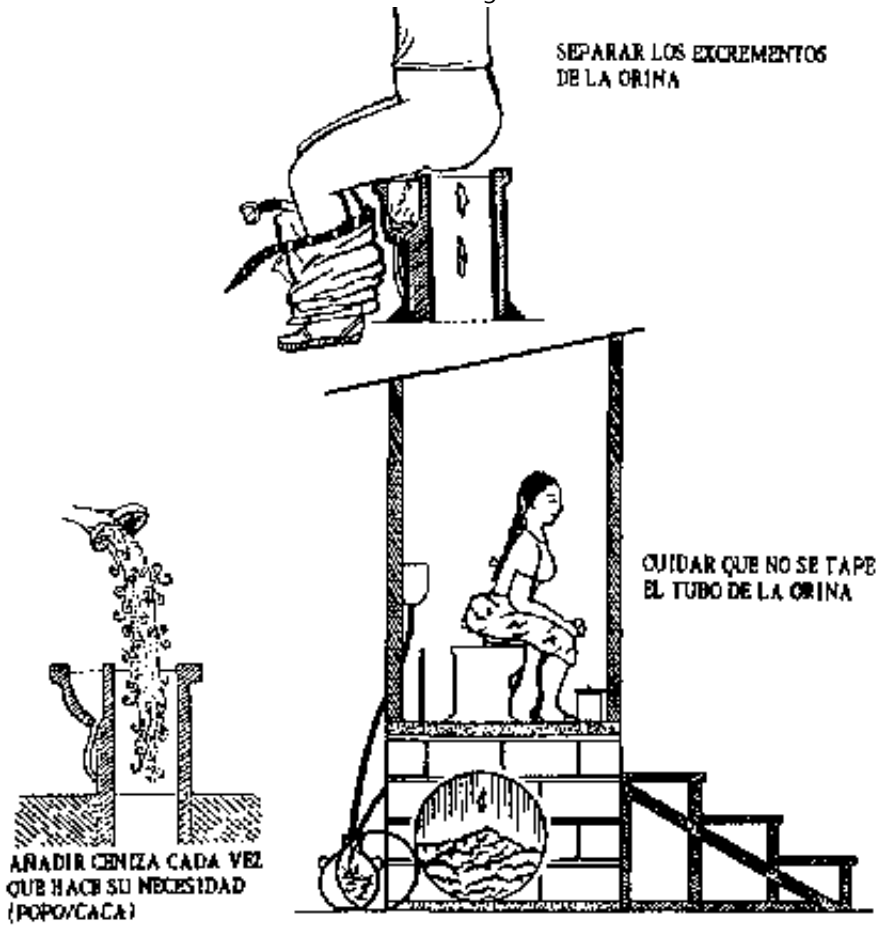
Other advantages of the DAFF latrine include the fact that it requires no digging, uses local materials, does not pollute soil or water (a hazard of pit latrines), and

produces fewer microorganisms than pit latrines (thereby reducing the risk of disease).

The DAFF latrine is an aboveground, two-chamber system. A portable toilet seat is placed over the opening of one chamber. Each chamber funnels off urine into a special container. The urine is mixed with water and allowed to stand for 3 days, at which time it can be used as a liquid fertilizer. After each defecation, wood ash or a mixture of soil and lime is placed in the chamber. This keeps the deposit dry, inhibits odours, reduces the presence of flies, and helps speed composting to fertilizer. The toilet seat is moved to the empty chamber when the first is full. The first chamber is sealed for 6 months, while heat and evaporation eliminate the moisture, thereby killing the bacteria. The contents are transformed into a safe, rich fertilizer. An opening in the back wall of the chamber gives easy access to the fertilizer.

During 1982-86, CEMAT transferred the DAFF latrine technology to 10 national and international NGOs and five public national institutions working in the field of sanitation. At the international level, the technology was transferred to Mexico, the Dominican Republic, and Panama. At a session in Mexico, 43 community leaders from seven countries were trained in DAFF latrine technology.

Later in 1986-87, a survey conducted in Guatemala showed that 16 institutions had installed 3000 DAFF latrines in different parts of the country. CEMAT has implemented a project to provide support to these groups in the promotion of the latrines, including: how to promote social acceptance; sanitary control and maintenance; and research on the performance of the fertilizer.



USO

National workshops have been organized to discuss the benefits and limitations of the latrines; videos and demonstrations have been used to inform farmers.

Prerequisites

Local materials for building (soil, adobe, brick, cement or stone, bamboo or cane, grass); availability of ash, lime, or dry organic soil. Community involvement and training is essential for social acceptance.

Potential users

Rural farmers anywhere; NGOs and community groups concerned with health promotion and agricultural improvements. The technology is especially useful in areas where it is difficult to dig pit latrines.

Cost

Cost depends on materials used. The entire unit can be built with cement, mud, and grass for less than $100.

Contact

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Resources and publications

- **Ficha No.1: La Letrina Abonera Seca Familiar, CEMAT, 1990, 37 pp. Updated manual in Spanish on the building, maintenance, use, advantages, and agronomic use of the DAFF latrine.**
- **LASF - Una Letrina para la Familia, Jacobo Schiere, Comite Centra Menonita, Guatemala, 1989, 67 pp.; US $8.**

- **Social, Sanitary and Agricultural Evaluation of Dry Alkaline Family Fertilizer Latrines in Guatemala, CEMAT, 1988, 15 pp.; US $2.**

- **Boletin RED, CEMAT. A trimestrial Spanish-language newsletter dedicated to disseminating information on appropriate technology for Latin American peasants. Subscriptions (incl. airmail): Latin America, US $5 per year; other, US $7 per year.**

71. Action-oriented methods for workers to assess occupational health

In Mexico as in many countries, there is a lack of aware-ness and action relating to occupational health. Haphazard complaints are rarely sufficient to get an effective response from management. There is a need for hard facts to reinforce demands for better working conditions. In response to this situation, researchers at the Universidad Autnoma Metropolitana in Mexico City developed and tested participatory techniques that enable workers in developing countries to measure for themselves occupational hazards and their impact on workers' health.

The method was tested in a steel factory called SICARTSA, in collaboration with the local union and 830 union members. The methods used included collective questionnaires, site inspections, analysis of health data obtained from the union, environmental measurements in the workplace, and data analysis using epidemiology techniques.

The study began with the premise that a useful methods must be accessible to groups of organized workers, produce reliable information on health risks and damages, be action-oriented, and use preventive and epidemiological criteria.

The main technique used and evaluated was the collective questionnaire on the assumption that the day-to-day experience of a group of workers is a rich source of knowledge that needs to be systematized. The process provides a global

diagnosis of the main risks and health effects of the workplace, how they are produced, and where they are concentrated in the labour process. The collective questionnaire also provides a forum for collective consciousness-raising and concrete action proposals, and doesn't require many technical resources. It increases workers" confidence by involving them in the identification of problems and their solutions.

Workers are divided into groups according to work stations, and information collected from them. Only information that is recognized by the whole group is admitted, and there is some verification of the information in the work areas, through medical examinations or with other groups of workers. The information is tabulated and a "risk map" drawn up, which illustrates the labour process, risks, disease symptoms, protective measures already in place, and proposals for new actions. The risk map is an instrument for action that allows workers to see relations as well as changes that are made.

Information is divided into five risk groups:

- **Risks from temperature, noise, light, humidity, etc. inside and outside the factory;**
- **The work environment (dust, fumes, gases, vapours, radiations, vibrations);**
- **Intense physical activity and forced positions;**
- **Psychological strain (shiftwork, night work, danger, tight supervision, monotony, high work speed);**

- **Insufficient security in the machinery and installations.**

The project has produced a manual (see Resources and Publications, below) in a popular format for use by workers and unions. The manual is divided into three sections:

- **Information on work-related health problems and what workers can do;**

- **The advantages and disadvantages of different methods for studying health effects in the workplace;**

- **The results of the study done in the SICARTSA steel mill, including the characteristics of the workplace, the health risks of metal work, preventive measures, and the demands made by the workers to solve the problems.**

This very detailed manual also includes sample questionnaires.

Potential users

Workers' organizations and unions in developing countries. The first of its kind, the manual is being used by unions in several countries including Brazil and Spain. In Mexico, the package was used by the 45 000-member

Mexican electricians union to organize a study on occupational health.

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Resources and publications

- **A video has been produced recording the process undertaken at the SICARTSA steel mill. Contact the researchers above.**

- **Trabojo y Salud en SICARTSA, Programa de difusin cultural del SITUAM, 1987, 144 pp. Detailed report on the SICARTSA study.**

Conocer para Cambiar, Estudio de la Salud en el Trabago, Universidad Autnoma Metropolitana, 1989, 211 pp. A detailed manual in Spanish, written in a popular format.

72. Fog-water catchment for water supply in arid areas

Various regions around the world suffer from chronic water shortages. In some, such as the Pacifc coast of South America, the Atlantic coast of Southern Africa, and some Arab countries, there are persistent fogs coming in from the sea that do not provide rain but that could be a source of good-quality water.

The Northern part of Chile is one of the driest areas in the world. There is a lack of

good groundwater, very little rain, and practically no rivers that can be used for irrigation and human needs. In the coastal fishing villages of Northern Chile, potable well water has to be trucked in from as far away as 50 km at great expense. It often arrives contaminated. The local people use very little water, and the lack of water is a major contributing factor to the migration of people to the cities.

Researchers have now developed a means to use the local fog (called camanchaca) as a source of good water. Along the coast of Chile, there is a persistent and extensive cloud deck (but little or no rain) that creates fog in the slopes and peaks of the coastal mountains, where the ground intercepts the low clouds. Small natural forests have developed using only the camanchaca moisture for survival. Artificial collection of water from the camanchaca is believed to have been an ancient native tradition that has now been lost.

The fog moisture can be caught using large rectangular water collectors, some 40 square metres in area, made of a nylon mesh called Rashell. This mesh is available locally at low prices and performs well. The installation of the collectors is straightforward and relatively inexpensive. Little maintenance is required, and it can be done easily by local populations. With simple chlorination, the water is of much higher quality than the treated water of Santiago.

The collected water can then be channeled to local villages and afforestation projects. A dependable source of water has the potential to increase human settlement in the area, reduce urban migration, and develop local resources, such as fishing and mining.

For the villagers, fog-water catchment will mean 10 to 20 times more water available at a much lower cost. Currently, villagers in the area use an average of 14 litres of poor-quality water per person per day; fog-water catchment using 60 water collectors can produce for the same village from 25 to 50 litres of better-quality water per person per day. In 1988, trucked-in water cost US $8 per cubic metre (partially subsidized by the government). Fog-water catchment is estimated to cost significantly less, perhaps as little as $2 per cubic metre.

Currently 50 collectors are in place, providing up to 7200 litres of water per day. The pipeline to the village of Chungungo was inaugurated in May of 1992. Meanwhile a new prototype collector, easy to construct and maintain, has been developed and tested. Twenty-five collectors based on the new design are being installed on a new site in 1992. It is expected that they will be able to produce an average of 10 litres of water per square metre of mesh.

Fog-water catchment is now also being used in Islay province on the coast of Peru, in collaboration with the Instituto Nacional de Investigacin Agraria y Agro-Industrial of the Ministry of Agriculture. Seven collectors have been installed, providing an average of 4.5 litres of water per day per square metre of mesh, for a total of about 120 litres of water per day.

Prerequisites

Consistently available fog that can be intercepted on land. Other than a persistent cloud deck, four other conditions are important:

- **A mountain range with an average altitude of 500 metres or more;**

- **The principal axis of the range should be perpendicular to the prevailing wind (this increases the amount of water collected);**

- **The site for water collection should be close to the coast;**

- **The presence, on the other side of the mountains, of a broad basin with high daytime temperatures helps to suck the ocean air through the mountains.**

Cost and availability

The cost of each water collector was approximately US $285 in 1988. Sixty collectors plus reservoirs, pressure-relief stations, and pipes was estimated at $27 000. This implies a cost of approximately $8 per cubic metre of water over 1 year, and $2 per cubic metre of water over 5 years.

Potential users

Coastal communities in Northern Chile and Peru and others around the world in coastal areas or islands with little rainfall and similar atmospheric conditions. These include: the Atlantic coast of Southern Africa (Angola, Namibia); Cape Verde; China; Haiti; and Oman and Eastern Yemen.

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Dr Robert Schemenauer Atmospheric Environment Service Environment Canada 4905 Dufferin Street Downsview, Ontario, Canada M3H 5T4 Tel.: (416) 739-4606; Fax: (416) 739-4211

Resources and publications Plans are underway for the production of a booklet and two 20-minute videos to promote the technology.

73. Portable water testing kit

In Malaysia, as in many other countries, testing the quality of drinking water is essential to protect people from water-borne diseases such as cholera, typhoid fever, dysentery, polio, and hepatitis. Standard methods to test bacteriological water quality are costly, time-consuming, and require well-trained staff and laboratory facilities. This makes it difficult to routinely test water sources in remote areas.

Researchers in Malaysia have now developed a prototype portable water-quality testing kit that is inexpensive, easy to use, and effective under field conditions. The kit uses an adapted version of a test called APHA 919C, for the detection of coliphages in water samples. Standard tests measure the presence of coliforms in the water, which is a more complex process. Coliphage testing is simpler, less expensive, and has been shown to be a useful indicator of the level of fecal

contamination in the water. The test involves incubating the sample in a host culture. Various changes to the test have simplified the process and allow for incubation at ambient temperatures (25 to 35°C).

The method is useful for testing water in open wells, tube wells, rivers, and other surface waters, and small-scale water supply systems. The quality of untreated surface waters can be determined rapidly with a 6-8 hour incubation time. Standard water quality tests need a 24-hour incubation time for an accurate assessment.

The prototype kit consists of a styrofoam box in a canvas sheet, which protects the contents from sun and rain, and maintains a constant temperature inside the box. With a capacity for eight tests, each kit contains: media in bottles in stainless steel trays; the bacterial host in dried form; petri dishes; syringes; receptacles; a camping gas burner; a lighter; and a pair of tongs. It can be carried by hand, on a bicycle, or in a vehicle. It measures 38 cm x 25.5 cm x 33.5cm and weighs 6.4 kg.

The kit has proven to be reliable. The design is currently being modified for mass production. Further improvements may include: reducing the weight by using plastic bottles instead of glass; replacing syringes with pipettes; finding a less expensive gas burner. A manual and training course are also being prepared. The kit has the potential to develop self-sufficiency of communities in testing their own water.

Potential users

Health and environment government departments and other organizations

involved in monitoring water quality.

Prerequisites

About half a day of training is all that is required to use the kit.

Cost and availability

The kit is still at the prototype stage. It is estimated that it will cost about US $95 for an 8-test unit, and US $175 for a 24-test unit. This amounts to US $7 per test with 44 cents per test for replacement items (media and syringes). This compares favourably with existing field kits which cost US $1000 to $1700 for a 24-test unit or about $50 to $75 per test.

Contact

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74. Solar-powered desalinators to provide drinking water in arid areas

Providing potable water is a major problem in many areas across Africa. Years of drought in desert regions have meant that surface water and shallow wells are not being replenished by rainfall. Climate changes in the fragile ecosystems can affect the survival of entire groups of people. In Botswana, 80% of the population depend on boreholes for their water. However, drilling for water is expensive and often disappointing. More than half the boreholes in some areas of Botswana

result in scarce or salty water. Some 70 communities depend on trucked-in water, but this system is expensive and often unreliable.

The Solar Energy Section of the Rural Industries Innovation Centre has developed and tested several prototypes of small-scale desalinators for areas with water that is too salty for human consumption. Saltwater can come from boreholes or salt pans (surface depressions that collect water).

The desalinators are simple to operate and maintain, are relatively inexpensive, and can provide drinking water under harsh conditions. They produce clear, good-tasting water and also provide salt for cooking, preserving meat, and curing game skins.

The desalinators have been well accepted by remote communities in the Kalahari desert, where they have contributed to community spirit and served as a basis for other development initiatives.

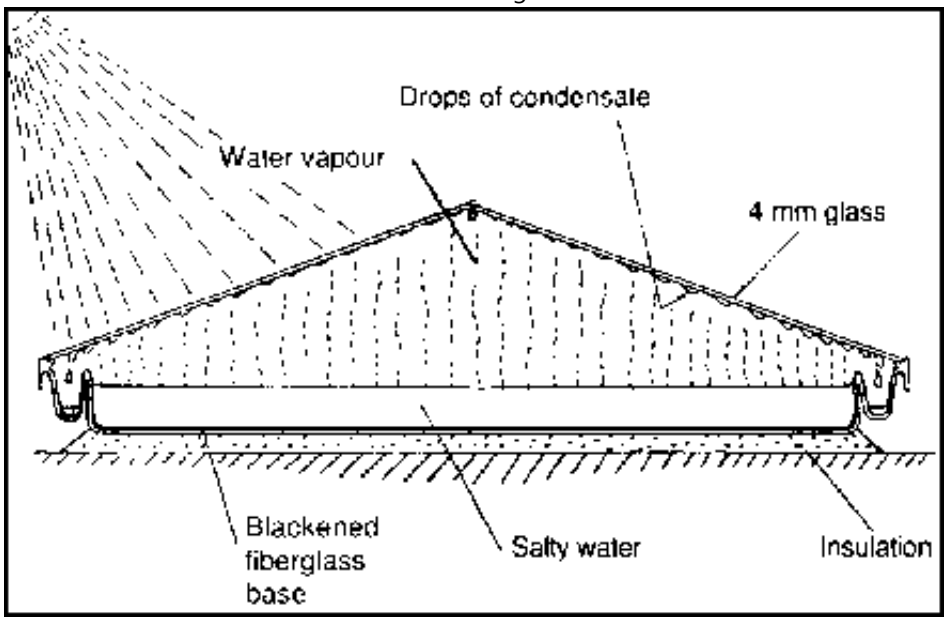
As opposed to trucking in water, desalinators promote self-sufficiency of communities in relation to water supply. Although the desalinators don't meet all the water needs of a community, especially in the winter, the people have assigned them a high social value. They also reduce migration to other areas because of an unreliable water supply.

The desalinator is a glass-covered airtight basin with a black base that absorbs the sun's radiation. The salty water is introduced into the desalinator and left in the sun to evaporate; the air becomes saturated with water vapour and condensation occurs on the coolest surface: the glass. The glass is set at an angle

so that the condensed water flows down it rather than dropping back into the salty water. It is collected in gutters and directed to storage tanks, leaving the salt in the basin.

Two types of solar-powered desalinators have been developed. The first, the Mexican modified still, gives good performance and is simple to use. Its fibreglass basin is strong, flexible, does not corrode or leave a taste in the water, is easy to clean, and remains stable at high temperatures. It is small and portable (1.6-m^2 long and 62-cm high), can be stacked, and is designed to withstand transport over unpaved roads. The installation of the stills does not require skilled labour. The main drawback, however, is that fibreglass can be expensive.

The second model, the brick still, is much less expensive but is less durable and portable and produces less water. In Botswana, the brick stills were cracking because of the low quality of sand for plaster. Skilled labour is needed for installation or the effectiveness of the still will be compromised.



Figure

During the study, the Mexican still yielded 8 litres of water per day in summer and 2.5 litres per day in winter; the brick still yielded 4 litres per day in summer. Supplemental water had to be trucked in in the winter.

The distilled water is virtually salt-free. Because humans need some salt in their drinking water, the distillate has to be mixed with some of the salty water before being used as drinking water. An educational effort is often needed to persuade people of the importance of this step, which can seem superfluous or self-defeating.

The desalinators should not be seen as an end in themselves but as a means to an end. They are complementary to other water technologies and can serve as a base for other initiatives in a settlement. They can relieve human hardship in areas with harsh climatic conditions, while developing within the community a sense of

purpose and self-sufficiency.

Potential users

NGOs and community organizations working in desert areas where water supply is difficult and where salty water is available. The desalinators can be used communally, domestically, or for schools, clinics, etc.

Prerequisites

A reliable supply of salty water. Training in installation, operation, and maintenance is essential for the stills to be effective. A sense of participation and ownership of the technology by the community is also essential. They must see the technology as important for their survival or they won't maintain it. Building materials must be robust and resistant to corrosion by salt and degradation by sunlight and heat. All the materials used are locally available in Botswana and include: vermiculite-cement for insulation from the ground, cement, silicone sealant, fibreglass, resin resistant to sunlight, bricks and mortar for brick stills, PVC or cement for gutters, polypropylene pipes, nylon joints, clamps, weatherstripping, brass bolts, galvanized pipes, and standard 4-mm window glass (thinner glass will not resist hailstorms).

Cost and availability

The desalinators are not being produced commercially, but the RIIC will provide information and technical assistance to organizations wanting to undertake similar projects in other countries.

While the desalinators can be expensive, other methods of supplying water to remote arid areas are usually more expensive. Estimated total cost per still is US $340 plus US $230 for materials (storage tanks, fencing to keep out animals, etc.) for the Mexican still; and US $53 per square metre (or approximately $150 per still) for the brick still. The Mexican still pays for itself within about 2.5 years; the brick still pays for itself in less than a year, but requires more skill for repair.

Contact

Rural Industries Innovation Centre
Private Bag 11
Kanye, Botswana

Resources and publications

- **R. Yates, T. Woto, and J.T. Tlhage, Solar-Powered Desalination: a Case Study from Botswana, IDRC, 1990. Detailed information on all aspects of the desainators and their use.**

75. Ferrocement rainwater catchment tanks

The problem of the availability of potable water in rural areas is an ongoing challenge in many countries. Where there is adequate rainfall, the harvesting of rainwater for domestic use can be an inexpensive alternative providing relatively safe drinking water. Although rainwater catchment is not new, the technology is not widely used, in part because of the high cost of concrete to build catchment tanks. With the development of ferrocement technology, tanks can now be built that are durable and much less expensive.

In the Philippines, in the province of Capiz, 90% of the people have no access to safe, reliable water. The ground-water table is low and often salty. A low-cost, simple tank design using ferrocement technology has now been developed; it is accessible to the villagers, who can build the tanks themselves using materials commonly available throughout Southeast Asia.

In the Philippines, villagers expressed a strong interest in and acceptance of the tanks, which they built themselves after undergoing training. The technology has the following advantages:

- **Materials are easily available;**
- **The tanks can be built in various shapes and sizes;**
- **The construction skills are easily acquired;**
- **Construction requires only simple tools;**
- **Ferrocement is cheaper than concrete;**
- **The tanks require little maintenance (traditional tanks require overhauling every 2 years);**
- **The tanks are durable (they are expected to last up to 30 years), water-resistant, and have a high impact resistance.**

The tanks can be built to hold from 4000 to 10 000 litres of water. The walls are only 3-10 cm thick, depending on the size of the tank, but because they are

reinforced internally with a framework of large-gauge welded steel mesh covered with fine wire mesh, they can support the water pressure.

The building of the tank consists of four major steps:

- **Preparing the foundation (a concrete pad covered with a polythene sheet or waterproof cement bags);**

- **Constructing the mesh "cage," made of two layers of large-gauge welded steel mesh, each covered by fine wire mesh held in place by short lengths of wire;**

- **Plastering the cage with mortar, made of 10 parts cement, 15 parts sand, and 4 parts water;**

- **Curing the tank, which takes one full month. The tank then be checked for leaks, dried out for 3 or 4 days and the inside painted with nontoxic paint. The tank is then connected to the roof gutter and household pipes.**

A builder's manual that can be used by semiliterate villagers has been published in Tagalog by Kabalikat Ng Pamilyang Pilipino, a Philippine NGO (see below). Training for the villagers of Capiz included clean water usage, community organizing, how to choose an appropriate technology, site selection, and building and maintenance of the tanks. A revolving fund has been set up to finance the building of the tanks.

Prerequisites

A tank can be built in about 1 week by three to five masons. Materials needed are

concrete (for the base), large-gauge welded steel mesh, fine wire mesh, mortar, and pipes.

Potential users

Individuals, communities, schools, clinics, etc. in areas where potable water supply is a problem but where there is adequate rainfall.

Costs and availability

Cost of materials (but not labour) will vary from about Can $300 to $1200, depending on size.

Contact

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Resources and publications

Ferrocement Rainwater Catchment, a builder's manual based on drawings and minimal text in Tagalog and Ilonggo. The manual can be obtained from: Kabalikat Ng Pamilyang Pilipino, MCPO Box 189, Makati 3117, Metro Manila, The Philippines; tel.: 8184158; telex: 722-23102; cable: PIACTMNL.

(Refer to technology 59 for more information about ferrocement).

76. The PVC handpump

For many years, handpumps installed in rural areas of the Third World failed because they were not adapted to the rugged conditions (they were often used continuously for up to 18 hours a day by different people at different rythms, with little maintenance). In 1978, IDRC supported research at the University of Waterloo which resulted in a new prototype shallow-well handpump.

The pump's innovation was that certain underground parts (piston, cylinder) were made from an inexpensive plastic material called polyvinyl chloride (PVC). This highly resistant material is used extensively both in the North and the South and is easier to handle than metal (PVC parts are glued rather than soldered). PVC does not rust, which gives water obtained from a PVC pump a better taste and odour. The new pump was light, sturdy, easy to transport and install, needed little maintenance, and was inexpensive.

Researchers in various countries have adapted the model to suit local conditions and needs. The most successful model to date, the UNIMADE handpump, was developed at the University of Malaya, Malaysia. This model is being used and adapted in 13 countries. Organizations in Ethiopia and Sri Lanka have developed their own prototypes. Feedback from pump users in various countries has been taken into account in the design of the latest models, which represent state-of-the-art plastic handpump technology. Currently some 7500 PVC pumps are in use around the world.

In Sri Lanka, a modified pump is being used in a program to train women pump technicians. The Sarvodaya Shramadana Movement, Sri Lanka's largest NGO, has

developed a unique training program that provides young, rural women with the opportunity to become self-sufficient economically while providing a much-needed service to their rural communities. A division of Sarvodaya, the Sarvodaya Economic Enterprises Development Services (SEEDS), provides training to the women in handpump technology, metal work, carpentry, masonry, shallow well-drilling techniques, health and sanitation, management, accounting, and village-level economics.

These "women of the handpump" operate workshops for the manufacture of pump components as well as tools such as axes, knives, and coconut scrapers, thereby ensuring themselves an income and increasing their technical skills for other village-level work.

Prerequisites

Adequate groundwater supplies; willingness of villagers to accept and use the handpump; ability to build, install, maintain, and repair the pump (the pump should be adapted to local conditions and availability of materials and parts).

Potential users

NGOs, governments, community groups, women's groups, and others working in the area of water provision from groundwater in rural areas.

Network

The University of Malaya is the headquarters of a network in PVC handpump technology that links China, India, Indonesia, Malaysia, the Philippines, Sri Lanka,

and Thailand in Asia; Cameroon, Egypt, Ethiopia, Kenya, and Mali in Africa; and Costa Rica in Latin America. It has become a forum for research, information-sharing and training for small businesses and community groups on all aspects of the technology, including manufacture, installation, maintenance, evaluation of performance, financing, and community organization.

Cost and availability

The UNIMADE handpump comes in four models ranging in price from US $70 for a lift type pump with a depth capacity of 12 metres, to US $136 for one with a depth capacity of 50 metres. The most commonly-used model, with a depth of 30 metres, costs US $120, a third to a fifth of the cost of similar handpumps on the international market. Various other adapted models have been developed in other countries. Information on these can be obtained through the PVC handpump network, at the address below.

Contact

UNIMADE Handpump, Professor Goh Sing Yau Department of Mechanical Engineering University of Malaya Lembah Pantai, 59 100 Kuala Lumpur, Malaysia Tel.: (0-3) 755-3466, ext. 260 Fax: (0-3) 757-3661; 757-8308 Telex: UNIMAL MA 39845 Cable: UNIVSEL

For information on the Sri Lanka women's handpump project, contact:

Mr Dulan de Silva Sarvodaya Economic Enterprises Development Services 41 Lumbini Mawatha Ratmalana, Sri Lanka Tel.: (94-1) 71-4577 or (94-1) 72-3597 Fax: (94-1) 72-3091

Other members of the handpump network:

- **Mr Vernick Barthelus, CARE Project Manager, BP 26, Bertoua, CAMEROON**

- **Mr Feng Bingyuan, Director, Chinese Academy of Agricultural Mechanization Sciences, No. 1, Beishatan, Deshengmen Wai, Beijing, People's Republic of China**

- **Mr Elias Rosales E., Fundacin Tecnolgica de Costa Rica, Apdo. 159-7050, Cartago, Costa Rica**

- **Mrs Samiha El-Katsha, American University in Cairo, 113 Sharia Kasr El Aini, Cairo, EGYPT**

- **Mr Aseged Mammo, R&D Engineer, Ethiopian Water Works Construction Authority, PO Box 1008, Addis Ababa, Ethiopia**

- **Dr Ranjit Singh, Reader, Mechanical Engineering Department, MR Engineering College, Jawahar Lal Nehru Marg, Jaipur, Rajasthan, India**

- **Ms Christina Aristanti, Assistant Director, Yayasan Dian Desa, 7 Km Jalan Kaliurang, Bulksumur, Yogyakarta, Indonesia**

- **Mr Mohamed Karama, Research Associate, Medical Research Centre, Kenya Medical Research Institute, PO Box 20752, Nairobi, Kenya**

- **Mr. Mamadou Diallo, Vice President, AMRAD, BP 1647, Bamako, Mali**

- **Mr Marieto Perez, Executive Director, Tulungan Sa Tubigan Foundation Inc., 2nd**

Flr Dona Maria Building, 1238 EDSA, Quezon City, The Philippines

- **Mr Pairojana Sornjitti, Director, Community-Based Appropriate Technology and Development Services, Population and Community Development Association, 8 Sukhumvit Soi 12, Bangkok 10110, Thailand**

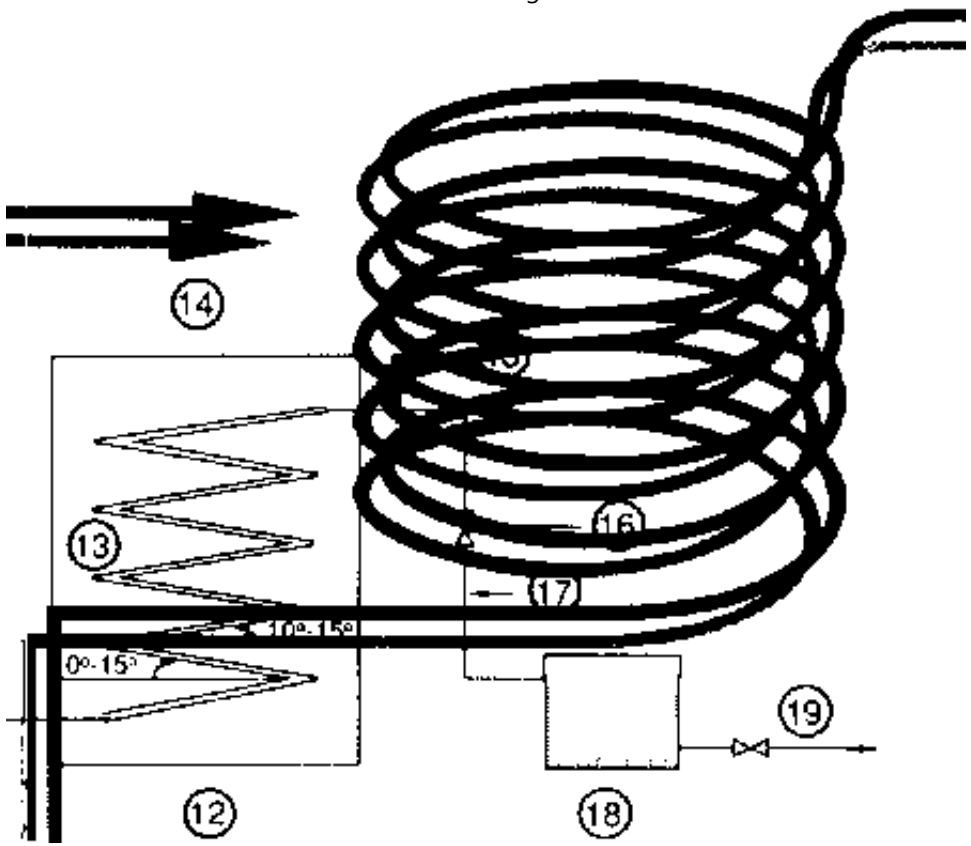
Resources and publications

- **A Handle on Health, 28-mint film on the design and local manufacture of simple, durable handpumps and how women can take control of the water-delivery system and its maintenance, IDRC, 1986.**

- **Waternet News, a quarterly newsletter published by the Research and Training Centre, University of Malaya, and distributed to the members of the PVC handpump network.**

77. Water disinfection using solar radiation

Obtaining clean drinking water is a continual challenge in many countries. Often the only water available is rife with disease-causing bacteria, and must be disinfected to make it safe. Conventional methods for disinfecting drinking water, including boiling and the addition of chlorine compounds, can be time-consuming and expensive. There may be procurement and distribution problems for chlorine compounds can also give the water an unpleasant taste. In many areas there is no fuel for boiling water.



The main part of the solar reactor is a transparent serpentine tube.

Researchers in Lebanon have developed a low-cost, practical means to provide safe drinking water to rural and urban areas, using the ability of sunlight to destroy bacteria. Solar radiation is a form of renewable energy that is abundant and accessible in most Southern countries.

The researchers began by exposing water to sunlight in batches, in plastic bags and clear or blue-tinted pyrex glass containers. The bacteria in the water were destroyed in about 75 minutes. Water in regular glass containers required 175 minutes. They also tested a process called the halosol technique, where relatively

high doses of sodium hypochlorite (chlorine) are used to disinfect small volumes of heavily polluted water. The water is then dechlorinated through exposure to solar radiation, which removes the bad taste and smell. In pyrex containers, 99% of the chlorine was removed after 110 minutes of exposure. In plastic bags, only 35 minutes of exposure was required.

After confirming the success of exposing water to the sun in batches, the researchers designed a flow-through system for continuous disinfection of larger quantities of water. In this system, a storage reservoir is connected to a tank, from which the water is directed by gravity at the desired rate through a solar reactor. In one prototype, the reactor is a serpentine pyrex tube resting on a metallic surface angled at 35° facing South, for maximum exposure to the sun (this angle may vary according to the location). The second prototype uses a solar reactor made up of four pyrex glass containers and one pyrex glass helix, which increases its total capacity. The disinfected water is then conducted to a distribution tank.

The flow-through system can also be used with the halosol technique, to remove excess chlorine from heavily-treated water. The researchers continue to work on improvements to the system. These improvements may include increasing the system's capacity by increasing the diameter of the pyrex tubes, and installing a radiometric device to synchronize the water flow with variations in the intensity of sunlight.

Prerequisites

The system can be made locally from pyrex, which is a good transmitter of solar

radiation, durable, and locally available in Lebanon. In areas where pyrex is unavailable, other durable plastics that are relatively inexpensive and can be locally molded can also be used. In the first prototype, called type I, the glass tubing is 13.4 m in length, 22 mm in diameter, and 1.5 mm thick. In the type II prototype, the glass helix is 10.5 m long, 12 mm in diameter, and 1 mm thick.

Potential users

Primary health care workers and technical people working in the areas of solar energy and water disinfection. The system can potentially be used in small communities, refugee camps, institutions, and in disaster situations where water supply is interrupted.

Contact

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Resources and publications

- **Water Disinfection by Solar Radiation, Assessment and Application, by A. Acra, M. Jurdi, H. Mu'allem, Y. Karahagopian, Z. Raffoul, IDRC 1989, 86 pp.**

78. Rice husk ash filters for potable water

In India, 80% of public health problems come from water-borne or water-related diseases. There is a strong need for low-cost, indigenous technologies to help in the provision of potable water to the rural and urban poor.

Indian researchers have developed a family-size filter, using rice husk ashes, that is simple, inexpensive, and easy to build at the village level.

Rice husk ash (RHA) is an agricultural waste product that is abundant all over India, and costs almost nothing. It can be bonded with cement, moulded and shaped into any form, and does not require firing.

The researchers compared three filter models (using RHA bonded with prefired clay, RHA bonded with portland cement, and RHA bonded with cement in a pebble matrix). The performance of all three was acceptable, as they were able to remove nearly all suspended matter in the water as well as 99% of the bacteria. However, the filter design with the pebble matrix gave the best results.

The pebble matrix filter using RHA bonded with cement is a new concept. A cylindrical container is filled with pebbles, and the RHA mixed with 7.5% ordinary portland cement is then poured into it. The use of fine RHA (212 micron, but no finer) increases the efficiency of the filter. The pebbles, preferably small, support the filter material and provide the following advantages:

- **Filtration is improved as the water has to follow a tortuous course;**
- **The pebbles prevent cracking and shrinking of the RHA-cement filling when it dries;**

- **The weight of the pebbles compresses the filling, decreasing the porosity continuously from top to bottom, which is an ideal filter characteristic.**

The RHA-cement filter can be poured into a container of any shape, and does not require firing, only a few days of setting. The pebbles can be washed and recycled when the filter is clogged.

In tests, the filtered water was well within World Health Organization standards. Although it does not provide 100% bacteria-free water (it removes 99% of bacteria), it is argued that water that is completely bacteria-free could lead to the loss of natural immunity which is the first defense of people living in areas with inadequate sanitation and a lack of access to medical services.

Prerequisites

Availability of rice husk ash, portland cement and pebbles.

Potential users

NGOs, government services, and people living in rural or marginalized urban areas in countries where rice is grown.

Contact

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