Low-Cost VERMIFILTRATION Technology for Wastewater Purification by EARTHWORMS for Reuse in Farm Irrigation

(Research : Prof. Dr. Rajiv K. Sinha, Griffith Univ. Australia)

Waste-eater Earthworms

Eudrilus euginae

Eisenia fetida

Perionyx excavatus

VERMIFILTER Plant (India)

TRANSCHEM AGRITECH Limited

Importance of VERMIFILTRATION TECHNOLOGY in World to Resolve the Growing WATER CRISIS by Converting WASTEWATER into CLEAN RE-USABLE WATER

Less than 1 % WATER on EARTH is USABLE for Farmers & Society, 97.5 % is SALINE in Oceans & 2 % FROZEN in Alps. Groundwater is fast depleting all over world. Global Agriculture uses over 75 % FRESHWATER of Earth. UNEP has warned that within 25 years, half of the World's population could face hardship in finding enough Freshwater for DRINKING, SANITATION & FOOD PRODUCTION.

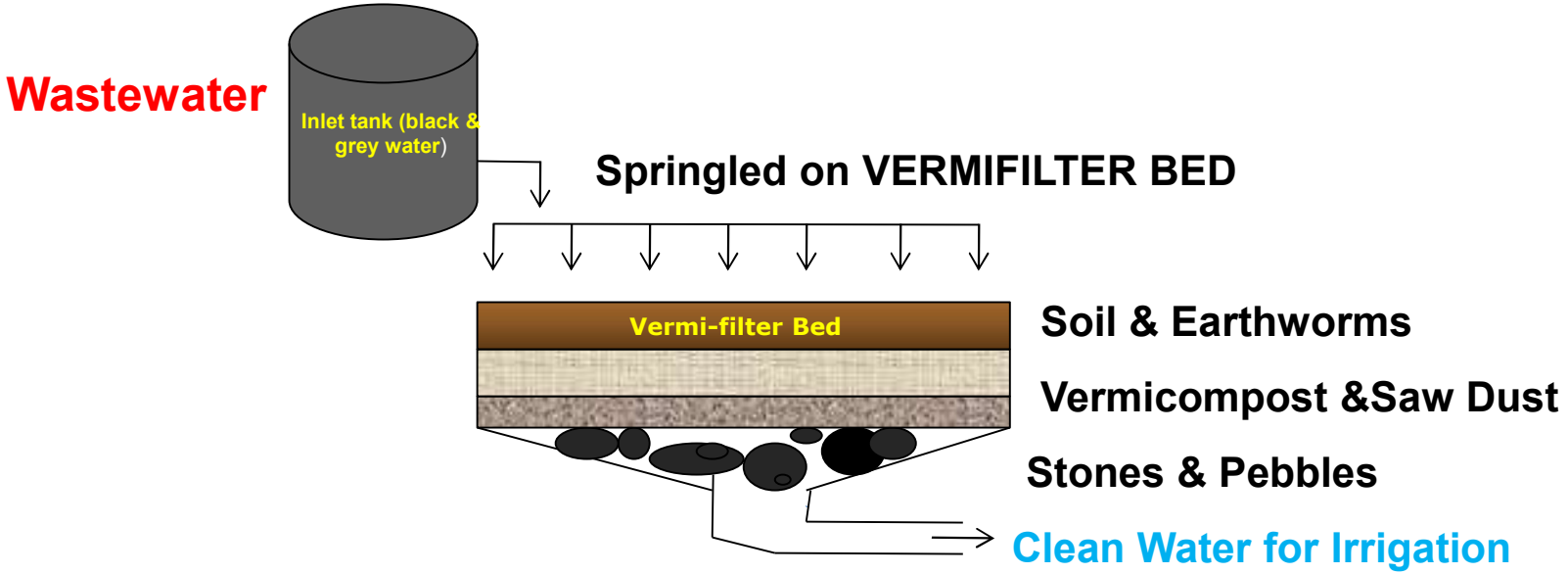
VERMIFILTRATION of all WASTEWATERS of Earth into CLEAN WATER to be re-used in AGRICULTURE & INDUSTRIES can Save Huge Freshwater of Earth. Only the EARTHWORMS whom Sir Charles Darwin called *'Unheralded Soldiers of Mankind'* can do this.

Studies by an Indian Ph.D Scholar Dr. Chandrajeet Kumar gave very High Growth & Productivity of VERMIFILTERED SEWAGE on Rice Crops. The SEED count in single branch was 371, which was only 176 in Crops grown on normal water. The WEIGHT & WIDTH of SHOOT & their GROWTH were almost 2 & 4 times higher. (Photos on Next Slide)

Rice Grown on Water

Rice Grown on Vermifiltered Sewage

- **The VERMIFILTER BED contains various grades of STONES & PEBBLES covered by layers of SOIL, SAWDUST, Crushed PLANT Materials & VERMICOMPOST in which resides the Waste-eater EARTHWORMS.**
- **All types of Wastewaters (Municipal & Industrial) & even the 'Toxic Wastewaters' can be treated by VERMIFILTRATION Technology.**



- **System is 'Self-Promoted', 'Self-Regulated', 'Self-Improved' & 'Self-Enhanced', 'Low-Energy', 'Zero-Waste Technology'; Easy to Construct, Operate & Maintain.**

Role of Earthworms in PURIFICATION (by DISINFECTION & DETOXIFICATION) of WASTEWATERS

Worms body work as a BIOFILTER. They 'DISINFECT' & 'DETOXIFY' the Wastewater & also make it 'NUTRITIVE' (rich in NPK).

The twin process of ENZYMATIC DEGRADATION by Earthworms & BIODEGRADATION by the MICROBES secreted by them work in the Vermifiltration process. Gut of Earthworms is a 'Microbial Factory'.

Earthworms bio-accumulate any 'TOXIC CHEMICALS' including 'Heavy Metals' in the Wastewater & render them HARMLESS by combining them with special Proteins called 'METALLOTHEANINS'.

They kill all the 'PATHOGENS' (Bacteria, Fungus, Protozoa & Nematodes) in the WASTEWATER by their 'ANTI-PATHOGENIC CEOLOMIC FLUID'.

BOD_5 is reduced by over 95 %, COD by 85 %, TSS by 95 %, TDS only by 15 % (as Nitrates & Sulphates are good for Agriculture) & TURBIDITY by over 95 % from the Wastewater. 'FECAL COLIFORMS' are removed by over 99 %. 'Dissolved Oxygen' (DO) value which is NIL in Sewage increases significantly in the Vermifiltered Sewage.

Worms also devours the SOLIDS in Wastewater (which otherwise forms the SLUDGE) & excrete them as their VERMICAST. Vermicast also ADSORB & remove the 'Organic & Inorganic' SUBSTANCES (including the Heavy Metals) from the Wastewater.

NUMBER & POPULATION DENSITY (Biomass) of the Earthworms in the Vermifilter Bed, their 'MATURITY & HEALTH' are important factors in Vermifiltration. About 8-10,000 Worms Per Square Meter of the Vermifilter Bed & in Quantity as 10 Kg Per Cubic Meter of the VF Bed is essential for Optimal Function of the Vermifiltration systems. As Worms multiply very rapidly this number is achieved quickly.

It is also essential for the Wastewater to remain in CONTACT with the Earthworms Body for certain period of time (at least 1-2 hours) for their PURIFICATION.

Economic & Environmental BENEFITS & ADVANTAGES of VERMIFILTRATION TECHNOLOGY

1). NO SLUDGE is formed which is a 'BIOHAZARD' containing several 'Toxic Chemicals' & 'Pathogens'. If any Sludge is formed, it is degraded into VERMICOMPOST by the Earthworms.

2). NO CHEMICALS are used to 'Disinfect' the Wastewater. Earthworms does the job.

3). NO FOUL ODOR as the Earthworms arrest 'Rotting & Decay' of all Putrescible matters in the Wastewater and the Sludge.

4). Uses 75 % 'LESS ELECTRICITY' & Less CONSTRUCTION Materials.

5). LOW emission of GREENHOUSE GASES inducing Global Warming (It is very HIGH in all Conventional SewageTreatment Plants)

6). It can also be 'DECENTRALIZED' avoiding long distance piping & transport of Wastewater to the Treatment Plants.

7). Generate Huge EARTHWORM BIOMASS every year which can be used to install more VERMIFILTRATION Plants & use of Earthworms by Farmers to boost Agriculture Production.

8). Investment & OPERATING COSTS are much LESS by over 70 % than the Conventional Wastewater Treatment Plants.

Scientific Role of TRANSCHEM Agritech (India) in Development & Operation of VERMIFILTER PLANTS in India Helping the Farmers & Society

- **TRANSCHEM Agritech Ltd. (India) Commercialized my VERMIFILTRATION TECHNOLOGY developed at Griffith University, Australia with great SCIENTIFIC IMPROVEMENTS**
- **Over 100 Commercial VERMIFILTER PLANTS are working in India in the States of Gujarat & Maharashtra under the Scientific Supervision of Dr. Mandar Prabhune, Technical Manager of Transchem.**

- **They are treating SEWAGE and WASTEWATERS from several INDUSTRIES & providing the VERMIFILTERED SEWAGE to the Farmers & Villagers suffering from severe WATER CRISIS for Farm Irrigation & Food Production.**
- **TRANSCHEM was HONOURED with 'Water Management Excellence Award' by the Govt. of India in 2017. Their Bhavnagar VERMIFILTER Plant (shown in next slide) is also on YOU-TUBE. See the 20 Mins. VEDIOFILM '*Wastewater Treatment by Earthworms – Dr. Rajiv Sinha*' with my comments & that of Dr. Mandar Prabhune.**

Main VERMIFILTER Plant at Bhavnagar (Gujarat, India) Treating 800 KLD (Kilo Liter) Sewage Per Day

(With Storage Tank for Sewage Collection)

Operating Successfully Since 2011

(Started with 200 KLD initially; Capacity rose to 800 KLD in 2015 due to High Growth of Earthworms Population in the Vermifilter bed)

VERMIFILTER PLANT SITE

Bhavnagar, Gujarat, INDIA

Sewage Spread on Vermifilter Bed by Sprinklers

Re-use of Vermifiltered Water in Garden at Site

Comparison of Untreated & Treated Wastewater from Bhavnagar VERMIFILTER Plant

Types & Sources of WASTEWATERS Treated by TRANSCHEM by Vermifiltration Technology

Treatment of Sewage (Municipal Wastewater)

- Urban & Rural Areas
- Small & Medium Scale Municipalities
- Factories
- Resorts / Hotels / Clubs
- Housing Colonies

Treatment of Industrial Wastewaters & Effluents

- Chemical & Petrochemical Industries (Toxic)
- Coal Washery Wastewater
- Milk Dairy, Chocolate & Candies
- Vineyards / Distilleries & Breweries
- Food Processing Units
- Fisheries, Meat & Poultry Processing Units
- Woolen & Textile Industries
- Color & Dye Industries (Toxic)

RESOURCES Generated in VERMIFILTER Plant Every Year

Report of TRANSCHEM

200 KLD

Sr. No.	Particular	Amount in Rs.
1	Nutritive Water fit for Agriculture / Horticulture (Detoxified & Disinfected) Rs. 5/ KL	3,50,000
2	Vermi-compost (20-25 MT/annum)@ Rs 3/ kg	60,000
3	Earthworms (Biomass) 2000 Kg @ Rs. 100 Per Kg	200, 000
	Total Revenue	6,10,000
	(-) Recurring Cost	4, 00,000
	Surplus Fund Generated	**2,10, 000**

1000 KLD

Sr. No.	Particular	Amount in Rs.
1	Nutritive Water fit for Agriculture / Horticulture (Detoxified & Disinfected) Rs. 5/ KL	17,50,000
2	Vermi-compost (20-25 MT/annum)@ Rs 3/ kg	300, 000
3	Earthworms (Biomass) 10000 Kg @ Rs. 100 Per Kg	10, 00000
	Total Revenue	30,50, 000
	(-) Recurring Cost	10,00, 000
	Surplus Fund Generated	**20,50,000**

ACKNOWLEDGEMENT

For Trusting & Giving Value to my Researches on VERMIFILTRATION & Bringing Honor for Me in the Scientific World by Commercializing my VERMIFILTRATION Technology

Honbl'e Sir Atul Shroff (CEO); shroffag@gmail.com

Dr. Mandar Prabhune (Technical Manager); mandarp@transpek.com

TRANSCHEM Agritech Ltd. Baroda, Gujarat, INDIA

For Giving Knowledge & Inspiring to Work on EARTHWORMS

Prof. Nirmal K. Mishra

Former Professor of Zoology, Patna University, India

Prof. Radha Kale

Former Professor of Zoology, Karnataka University, India

For Giving Moral Support to my VERMIFILTRATION Technology

Prof. Maria Soto

Vermiculture Scientist Working on VERMIFILTRATION, Univ. of Chile

Thanks to all Organizers

Prof. Rajiv K. Sinha

(Prof.Rajivksinha@gmail.com)

(Retd. Assoc. Professor of Environmental Science, Griffith University, Australia)

Selected by the IBC of UK among the 100 SCIENTISTS of World (2016).

Scientific Advisor, TRANSCHEM Agritech, (Gujarat) India

Remembering my STUDENTS & SCHOLARS (My Academic Army) Worked On VERMIFILTRATION Research Projects at Griffith University, Australia & in India

Uday Chowdhary, Gokul Bharambhe, Dalsukh Valani, Kunal Chavan; David Ryan, Ashish Brahambhatt, P.D. Bapat, Brijalkumar K. Soni, Vinod Chandran (Australia) Chandrajeet Kumar (India)