Constructed Wetlands: What Has Been Studied in Developed Countries and How This Can Help Developing Countries

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ABSTRACT

Various aspects of constructed wetlands have been studied intensively in developed countries over the past two decades. The study of constructed wetlands developed from the use of natural wetlands to purify effluents. Wetlands have been described as the kidneys of the landscape (Sundaravadivel and Vigneswaran, 2001) and for this reason are being engineered to enhance their treatment capabilities. The traditional parameters of BOD, COD, TSS, nitrogen, and phosphorus are the basis of most studies of constructed wetlands. Some studies also include pathogens (to various degrees of detail) and heavy metals as parameters. Constructed wetlands fall into two basic categories: surface flow (SF) and sub-surface flow (SSF). There are many variations and hybrids of the two types, but generally the SF constructed wetlands are utilized in warmer climates and the SSF constructed wetlands in colder climates. Constructed wetlands have found general acceptance in small, rural communities in developed countries, and there is now an effort to distribute the technological aspects of constructed wetlands to developing countries where little or no treatment of wastewater is realized. Constructed wetlands are an ideal technology to offer developing countries for wastewater treatment due to their simple construction, process stability, cost effectiveness, utilization of natural processes, simple operation and maintenance, and negligible energy input (Haberl, 1999).

KEYWORDS

Constructed wetland, surface flow (SF), sub-surface flow (SSF), substrate, emergent macrophytes, developing countries

INTRODUCTION

A great effort has been put forth in recent decades to study constructed wetlands for wastewater treatment. The constructed wetland has emerged as an engineering technology out of the use of natural wetlands for polishing of effluents from conventional wastewater treatment plants (WWTPs). A great deal of literature has been published on constructed wetlands in developed countries. There has been a recent movement to disseminate the technology of constructed wetlands to developing countries (Haberl, 1999). Before there can be an understanding of how constructed wetlands can be utilized in developing countries, an understanding of the general methods employed in developed countries must be realized. In brief, the constructed wetland is any bed used to treat wastewater by utilization of plants adapted to growing in an aquatic environment. Typically fine and coarse gravels are used as a substrate medium for the aquatic plants to grow in. Good design practices also incorporate an impermeable layer of either synthetic material or compacted clay to prevent seepage to groundwater. Selected aspects of constructed wetlands will be discussed followed by a presentation of some of the successes of constructed wetlands in developing countries.

WASTEWATER TREATMENT BY CONSTRUCTED WETLANDS

The ability to decrease the over-fertilization, pollution, and silting up of inland waters by using appropriate plants was first reported by Dr. Seidel of Max Planck Institute in Plon, Germany in 1953 (Sundaravadivel and Vigneswaran, 2001). Since this initial realization, studies have been conducted by various research institutes around the world. Due to the nature of constructed wetlands, they offer many inherent advantages as well as some limitations. The major advantages and limitations reported by Sundaravadivel and Vigneswaran (2001) include: