

## ***Communications:***

# **Reuse of Agricultural and Sewage Waste in Water Treatment: An Eco-regional Concept**

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**Abstract:** In order to apply an ecoregional concept to the treatment of wastewater, a consideration is given to the potential of reusing waste materials found within the same region. The production of activated carbon from agricultural waste and other sources such as sewage sludge is considered as key to providing a lowcost alternative in water treatment, this is in addition to its availability in every geographical region. Thus, in creating a balance for the co-existence of development and ecosystem conservation a sustainable approach is looked into for its potential. Among the numerous benefit to be derived from such a system are reduced expenditure for water treatment, safe disposal for agricultural and sewage waste and the idea of realizing self sustainability within the regional ecosystem.

**Keywords:** *Activated carbon, Ecoregionalism, Environmental management*

## **1. Introduction**

Ecoregional initiatives are being developed from concerns bothering around a diverse range of situations (Mason 2011). Environmental concerns influence both regionalism as an ideology and regionalization as a manifest process. In order to obtain the real benefits of regionalism it will be mandatory to make compromises in a pragmatic manner. New environmental regionalism implies that it is principally for the purpose of environmental policy that regionalism is pursued, that is for efforts to mitigate the negative consequences of certain occurrences such as water pollution. Water is essential for all life forms. Rivers and other watersheds have been the source of life, being a source of food for all living beings as well as useful for a number of other activities over time such as water supply for daily activities, mining and industries, recreation, transport system and many more. However, due to the lack of awareness and love for the nature, people have defiled most of their rivers by turning it into a convenient dumping spot for both industry and average individual.

The concept of regionalism is one that dates back to prehistoric times. It depicts the embodiment of similar goals and values within a geographical region, thus the importance of geographical relationship is highly emphatic in regionalism. The point to be considered here is the technical approach required to realize the ecoregional initiative. It is assumed that the process of utilizing the ecosystem's waste to treat the same system in a regionalize approach is considered as self remedy with a capacity to improve the environment without cutting down on peoples sources of livelihood. This

provides the opportunity of a sustainable means for the production of low-cost adsorbents for water and wastewater treatment. In this short review research, taking an example of activated carbon (AC), a theoretical perspective is considered as a potential process to mitigate contradictory relationship between ecosystem service and regional development.

## **2. Eco-regionalism and Targeted Service**

Regionalism has been a common tool used by government for national planning, which has now been adopted into environmental management with a view to bringing integrated management to the ecosystem in advancing environmental protection, use and management (Elliott 2011). The rationale of environmental management on a regional scale is one of high interest with issues arising from the reconciliation of ecological, jurisdictional, economic and social matters in a synergy of integrated management (Lane 2004). The ecosystem itself is considered as a complex of regional land systems that each sub-property of land attributes consist particular ecological units with unique biological communities. Human beings have lived deriving favor from ecosystem resources and services. The regionally unique ecosystem and cultural life of mankind have also developed interdependence with different types of unique regional ecosystems (Naveh and Lieberman 1993). Though, modern society has been developing without much recourse from such ecological regionalism. The isolation has been resolved its restriction from ecological regionalism, and it has been realizing its unlimited growth. As a result, increased demands of global economic performance are requiring more material and energy, thus less importance of ecological regionalism. This has led to a high exploration and exploitation of the ecosystem in meeting such demands of materials and resources for human livelihood and is gradually

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becoming the bane of mankind as waste from this process is having a detrimental impact on the system herself.

The concept of 'new environmental regionalism' which seems to boomerang amongst integrated management circles refers to a more recent wave of initiatives focusing on marine water bodies, river basins and more recently mountain. However, the potentiality of exacerbating some other issues is always a matter of concern as it is considered inevitable while enforcing such services (Balsiger 2011). The expected services from an ecoregional system (Sarukhan and Alcamo 2003) are defined from four aspects:

- 1) Provisioning service is potential products from regional ecosystem, such as, food, fresh clean water, and species-unique biological resources,
- 2) Regulation service is potential stability in local climate, disease, hydrology, water quality and pollination,
- 3) Cultural service is non-physical benefit from local property of spirit, religion, recreation, aestheticism, inspiration, education, presence, and cultural heritage and,
- 4) Supporting service is fundamental to generate former three categories of services by soil formation, nutrient cycle, and primary production.

The so called ecosystem services are provided either from natural environment or from regional secondary environment modified by mankind. Herewith, conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach (Convention on Biological Diversity 2000). The core issue of sustainable development has been realizing the inter-dependend sound arrangement between development and environmental properties. Thus, the rise of ecoregionalism thus creates an important conundrum relating to the co-existence of development alongside ecosystem conservation within the same space. Thus, this context is being applied in consideration for the use of AC in water treatment.

### 3. Eco-systematic approach towards self remedy

The quality of the river is directly influenced by the number of waste and contaminant discharged into it and hence affects the extent of which the water can be used for certain purposes such as water supply or even recreation. Other sources of pollution are agricultural lands and soil erosion. All the sources listed above could be categorized under two broad groups (sources) of pollution could be referred to as point and non-point sources. The land use of area surrounding a river or stream corridor to a great extent impacts the condition of the water body, human activity has profoundly affected rivers and streams in all parts of the world. In areas surrounded by agricultural activities, common contributors to water pollution are nutrients and sediments which typically enter stream/river as surface runoff or leachate of fertilizer or grazing livestock waste, which are considered nonpoint source pollution because the exact point where the pollutant originated cannot be identified (Anderson 1999). Nonpoint sources could also be grouped as rural and urban (Ongley,

Xiaolan and Tao 2010). On the other hand point sources are those whose origin can be located such as untreated wastewater from manufacturing industries or even wastewater treatment plants located within a catchment and riparian areas, these are more prevalent in urban areas.

As a result of the various intensive human activities in the river environment, the water quality in most rivers is degraded with a continuing decline world over. It is also found that many urban areas most especially in developing countries take their source of drinking (domestic) water from such rivers. Dominant local residents accommodate life in proximity with human impacted area. In fact, ionized excess nutrients and pollutant that affect hygiene are also providing from precipitation as symbolically known Hayes in Singapore and Malaysia. It is becoming more difficult to escape from such recursive environmental problems of mankind. This is the reason regional self remedy is considered. As an application of natural process, wetlands are known to contribute highly to human livelihood with a lot of biophysical, agronomic and socio-economic benefits (Kangalawe and Liwenga 2005). However, it needs to be recognized that these activities also have a potential cause the degradation of water in these areas and make it highly unhealthy to sustain both human and other habitat life. In the case of water bodies in rural areas where animal grazing and agriculture is prevalent, waste from agricultural produce could be used for the production of low-cost adsorbents that could be used in the final stage of water treatment in domestic water treatment plants or in filter units in individual homes to make water potable. Similarly, for the case of the urban areas with high level of industrial activities it is also possible to utilize materials such sewage sludge from domestic wastewater treatment plant to produce adsorbents. This adsorbent could be used in treating industrial wastewater from industries dealing with toxic substances prior to discharging such wastewater in river/stream canals. This offers dual advantage of converting waste into wealth at the same conserving the water environment and consequently human health as well. To demonstrate a technical approach, this study was focused on AC.

### 4. Water treatment technology and wastewater treatment

There are different methods used for the treatment of water and wastewater, including microbial degradation, chemical oxidation, ion exchange, membrane filtration, chemical reduction electrodepositing, reverse osmosis and adsorption (Anwar *et al.* 2009, Ajmal *et al.* 2003, Daifullah and Girgis 1998, Kim and Anderson 1994, Taty Costodes 2003). AC adsorption has high chemical and mechanical stability and high degree of surface reactivity. Extensive studies have shown that AC numerous applications viz; odour removal, removal of H<sub>2</sub>S or CS<sub>2</sub>, exhaust air cleaning, industrial waste water, drinking water conditioning (Alam 2009, Mohan and Singh 2002, Chuah 2005, Ramesh, Lee and Wong 2005, Passé-Coutrin, Altenor and Gaspard 2009). AC is generally considered to have beneficial environmental effects, thus its recommendation by USEPA to treat waste water effluent for

Table 1. Activated carbon production from various precursors showing its removal efficiency of environmental pollutants.

Source (Precursor)	Activating Agent	Target Pollutant	Removal Efficiency (%)	Reference
Cashew nut shell	KOH & CO <sub>2</sub>	Lead & Cadmium	99.90 & 98.87	Tanguak, S. <i>et al.</i> (2009)
Oil palm empty fruit bunch	N <sub>2</sub> & CO <sub>2</sub>	Phenol	99.5	Alam, M.Z. <i>et al.</i> (2009)
Bamboo	KOH	COD, TDS & Turbidity	93.2, 94.6 & 84.4	Hirunpraditkoon, <i>et al.</i> (2011)
Rice Husk	ZnCl <sub>2</sub>	COD & color	60 & 70	Kalderis, D <i>et al.</i> (2008)
Sugarcane Bagasse	ZnCl <sub>2</sub>	Chromium	>87	Cronje, K.J <i>et al.</i> (2011)
Sugarcane pith	H <sub>3</sub> PO <sub>4</sub> & ZnCl <sub>2</sub>	Reactive orange dye	80 - 99	Amin, N.K (2008)
Sewage sludge	H <sub>2</sub> SO <sub>4</sub> & ZnCl <sub>2</sub>	COD, P & Chromaticity	79.1, 98.3 & 87.5	Yu, L. and Zhong, Q. (2006)
Orange peel	H <sub>2</sub> SO <sub>4</sub>	Direct blue 86 dye	92	El Nemr, A. <i>et al.</i> (2009)
Olive bagasse	Steam	Chromium	97	Demiral, H. <i>et al.</i> (2008)

the adsorption of varying pollutants is promising for the future of the water environment, especially for developing countries.

Table 1 illustrates the performance of AC from different precursor sources on the removal of various pollutants. It can be seen that AC prepared from this various sources have been successfully used for the adsorption of a wide range of pollutants, both from liquid and gaseous phases.

## 5. Conclusion

Environmental management in wastewater treatment portends a great benefit in reducing the high cost of treatment being borne by authorities, creating wealth from waste, protecting human health and conserving nature's resources of water environment. The current high cost of treating water has burdened the authorities with large expenditure on water treatment and where such capacity is lacking it has a direct from the food industry (United States Environmental Protection Authority, toxic Substances Control Act (TSCA) 2000). Despite the prolific use of this adsorbent for water and waste water treatment, carbon adsorption is an expensive treatment process and this prompted a growing search for a good substitute of AC (Marzal 1996, Marshall and Johns 1996, Seco 1997, Wilkins and Yang 1996). In continuing search for efficient adsorbents from new and cheap readily available raw material, agricultural wastes and other alternative precursors are being processed into AC to be used in the removal of various pollutants from water and wastewater. The ability to turn such waste materials into activated carbon bearing on the health of the populace, as the case is with some developing countries.

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