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2. Environment Sustainability: Reduce, Reuse and Recycle

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Abstract:

The Reduce, Reuse, and Recycle (3Rs) principle administer minimization of waste and energy requirement, a circular economy for reducing waste, and a maximum level of recycling of the products as possible. Sustainable energy and water management practices are applied in fewer industrial settings to prevent environmental degradation. The term reuse is defined as the product utilization in further subsequent life cycle i.e., reusable plastic and containers.

Reusing the product processing accessories reduce the manufacturing cost and uplift revenues. The reusing of products by consumers also contributes to mitigating carbon footprint. Recycle often used for the conversion of organic or inorganic materials into fresh products rather than reusing the same product.

The Hospitality sector is required high resources, energy, and water consumption. The single-use goods are extensively used in this sector so the effective 3Rs strategy needs to be developed in the hospital sector without compromising the quality of service. Similarly, the tourism and hospitality sectors are using single-use products for their customers to serve excellent service quality and to maintain hygiene around. A possible strategy could be the use of biodegradable single-used products instead of non-biodegradable synthetic products.

Keywords:

3Rs, Reduce, Reuse, Recycle, Sustainable energy, Environmental degradation, Biodegradable, Carbon footprint

2.1 Introduction:

The growing population demands Reduce, Reuse, and Recycle (3Rs) approach in waste management practices. The waste needs to reduce and reuse and recycle by promoting science and technological research in 3Rs. The 3Rs approach enforces reduced waste generation, selects reusable products and encourages people to reuse the stuff, and inspires people to use recycled articles. The 3Rs are further extended to 7Rs i.e., Reduce, Reuse, Recycle, Resource, Regenerate, Replace and Recover (Figure 2.1).

Several scientific and technological measures are developed to prevent the rate of pollution and energy-saving strategies. The introduction of clean and green technology helps to mitigate undesirable waste effluents and emissions from industrial manufacturing practices. The 3Rs ensure minimum damage to the ecosystem (Ilgin and Gupta, 2010).

Environmental degradation is an area of concern due to excessive pollutants are entered the biological food chain of the ecosystem. To minimize environmental degradation academic institutions, organizations, enterprises, and manufacturing units are coming forward to take responsibility for sustainability in various aspects with a suitable strategy with an aim to improve environmental health (Tanwer et al., 2015; Ordóñez et al., 2019).

Corporate societies are now concerned about the environment and working on various environmental practices and ensure the proper allocation of resources to mitigate waste generation (Aragón-Correa and Sharma 2003).

The hospitality sector is also producing waste abundantly and needs to follow environmental sustainability at a different level of operations. 3Rs is a sustainable environmental strategy that safeguards the wastage of product and energy to make the commercial sector eco-friendly.

2.1.1 Concept of Reduce, Reuse, and Recycle:

The concept of 3Rs was introduced by Japan in 2004 at G8 Summit which was held in Georgia. Presently, the 3Rs are considered a significant approach to a sustainable and cleaner environment.

The waste materials generated from the industrial process first need to be analysed and assessed for the implantation of 3Rs. Bioremediation, Composting, Fermentation of waste for value-added products, and Bioenergy production are the common approach used under 3Rs (Ordóñez et al., 2019; Xu et al., 2018; Singh et al., 2012). Bioremediation offers the remediation of toxic pollutants from soil and water.

The microorganisms (such as bacteria, fungi, and algae) and plant species are participated in the bioremediation process due to their extensive metabolic competency, immobilizing capability, and toxic absorption efficacy to deal with environmental pollutants. Bioremediation has often used two approaches viz., biodegradation or biotransformation composting is a classic example of biodegradation of biomass to compost.

The biotransformation can be explained by the simple example of chromium toxicity. Trivalent chromium is essential for human health while Hexavalent chromium is unambiguous and toxic to humans.

The bacteria e.g., *Lactobacillus* are able to transform the Hexavalent chromium to its Trivalent form. Composting is one of the oldest practices in the agriculture field.

The waste and unused fruit and vegetable, fish scrap, processed meat, grains, and weeds could potentially be used for composting (Schaub and Leonard, 1996). The waste olive and palm biomass produce oils that are considered toxins for plants and animals due to their tannin and phenolic content.

The *Pleurotus* mushrooms can be used to detoxify olive and palm biomass by secreting certain enzymes and growing over them.

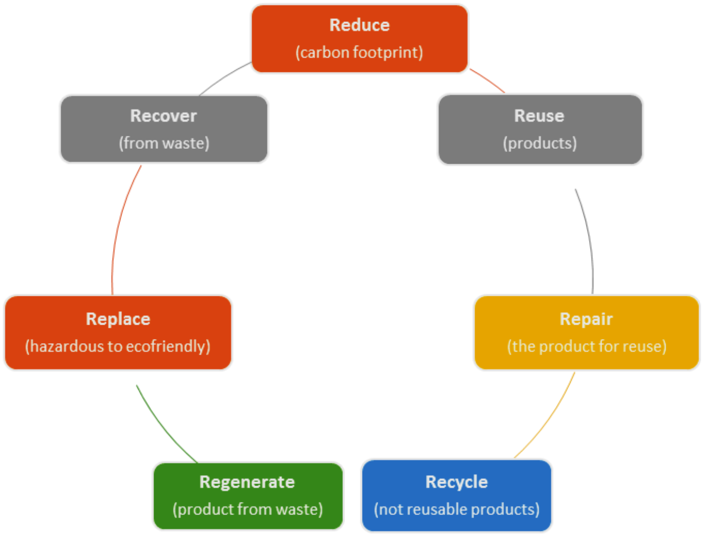

Figure 2.1: The 7Rs (Reduce, Reuse, and Recycle, Resource, Regenerate, Replace and Recover)

Persistent organic pollutants: Persistent organic pollutants (popular as POPs) are a group of toxic chemicals that cause harm to the environment and human health. They are considered a severe threat because they might cross the placenta and transfer through breast milk to offspring. The POPs are often manufactured as biocides and disease control agents. The pesticide e.g., aldrin and chlordane, insecticides i.e., *dichloro-diphenyl-trichloroethane* (DDT), dieldrin and heptachlor, and many more man-made biocides are considered as POPs. Some POPs are synthesized intentionally i.e., polychlorinated biphenyls, and others i.e., dioxins are generated by default as a by-product. Pariatamby and LingKee, (2016) revealed that Guar gum and Xanthan gum are the most suitable polymer for the treatment of POPs due to their biodegradability, non-toxic nature, cost-effective treatment procedure, and easy availability.

Plastics: Plastic pollution management practice could be linked to the reduction of single-use plastics and plastic food packaging. The natural fibres are tending to degrade rapidly through biological mechanisms. Hence, the use of such fibres to make biodegradable plastic i.e., green polymers, comes into practice nowadays. The environmental half-life of bioplastic is pretty much shorter than synthetic polymers. The reusable BPA-free plastic bottles are promoted for daily use.

The plastic ware is recycled to make a variety of stuff useful for day-to-day life. Plastic waste is increased by around 300%, especially in the tourism sector, which is considered a severe threat to the ecosystem nowadays. Hence, single-use plastic ware needs to be beaned immediately or introduced into a proper recycling system to ensure the safeguard of human and animal health (EU Commission, 2018).

2.2 Possibilities of 3Rs Implementation in Healthcare Waste Management:

Healthcare waste is a key concern after COVID-19 because in the last two years plenty of waste generated. People are now taking excess concern for hygiene practices so lots of waste i.e., disposable tissue papers, several antiseptic liquids, phenolic compounds, cleaning agents, masks, and gloves, are generated by maintaining routine hygiene. However, this could be minimized by using reusable stuff as much as possible. Moreover, well-established healthcare settings are using disposable stuff excessively due to legislation guidelines offering flexibility in the choice of selecting disposable and reusable materials as per the necessity.

Thereby, sustainable waste management practices need to be implemented. Healthcare wastes are broadly categorized into infectious waste i.e., contaminated blood and bandages), pathological waste i.e., human tissues and fluids, samples, sharps waste i.e., syringes middle and disposable blades, chemical waste i.e., test reagents and disinfectants along with heavy metals, pharmaceutical waste i.e., expired medicines, Radioactive waste that generated from radioactive diagnosis, and other non-hazardous waste that free from biological, hazardous chemicals and radioactive wastes. Surprisingly, World Health Organization (WHO) stated that only 15 % of waste generated by the healthcare sector is hazardous and the rest of 85% of waste is mostly non-hazardous that can be treated and reused effectively. As an example, 16 billion injections are used annually worldwide but due to the lack of a recycling system, they are dumped as plastic waste. The mitigation of “waste crime” is another area of concern because the operators or owners often ignore the *waste* disposable regulations and hence, and the public may expose to such hazardous or toxic chemicals. The strict monitoring of healthcare procedures helps to control such activities. The open burning of health care wastes generates dioxins and furans like particulate which mix with the atmosphere and cause harm to the people.

The concept of "*waste hierarchy*" guides the people on which category of waste best suited the relevant management practices as the eco-friendliness. The healthcare sector is highly recommended to follow such practices. European Waste Catalogue provided the List of Wastes (LoW) under European Commission guidelines for healthcare in the United Kingdom (UK) to minimize the risk of human health from healthcare waste.

2.2.1 Circular Economy and Zero Waste Model:

The concept of circular economy deals with the sophisticated sustainable model from the manufacturing of goods or products to end disposal which comprises different levels of consumption including share, reuse, repair, refurbishment, and recycling of goods or products at the best possible long-lasting. This tactic helps to the extent of the product life cycle and reduces waste generation. The Zero Waste Model (ZWM) comprises of 3Rs method which is closely related to the natural systems of the earth's crust where the byproduct of one individual becomes a source of sustenance for another individual.

For example, humans and other animals exhale CO_2 as a byproduct of cellular metabolism, and the same CO_2 is consumed by Photosynthetic plants with and aid of photons to produce energy for the cellular process and the produced food stored as starch in the cell. Later when the starchy cell is consumed by herbivorous animals then after their cellular metabolism the starch is converted into CO_2 and water. However, ZWM can be implemented only when all the stakeholders take care of these management practices together.

2.2.2 Initiatives on 3Rs:

The 3Rs concept was first proposed by Japan and later spread globally. The 8th Regional 3R Forum in Asia-Pacific was hosted by the Ministry of Housing and Urban Affairs, Government of India in association with The Environment Ministry, Government of Japan, and UNCRD, United Nations, which was held in Indore, Madhya Pradesh, India in April 2018. The Regional 3R Forum was launched in Japan in 2009 to make policy, planning, and development strategy regarding 3Rs. The theme of the 8th Regional 3R Forum was "to achieve Clean Water, Clean Land, and Clean Air through 3R and Resource Efficiency (RE) - A 21st Century Vision for Asia-Pacific Communities.

Sustainable Environment Practices (SEP)

A British charitable trust, Waste and Resources Action Programme (WRAP) was established in 2000 to ensure that all the resources could be used sustainably. WRAP is working to promote and accelerate the efficient use of resources and to guard natural resources. The TripAdvisor online platform initiated Trip Advisor Green Leaders Programme (TAGLP) in collaboration with United Nations Environment Programme, Energy star, U.S. Green Building Council (USGBC). The TAGLP showcases eco-friendly hotels and resorts those committed to following green practices like recycling products, serving local organic food and dishes, and offering electric cars and charging stations to travellers.

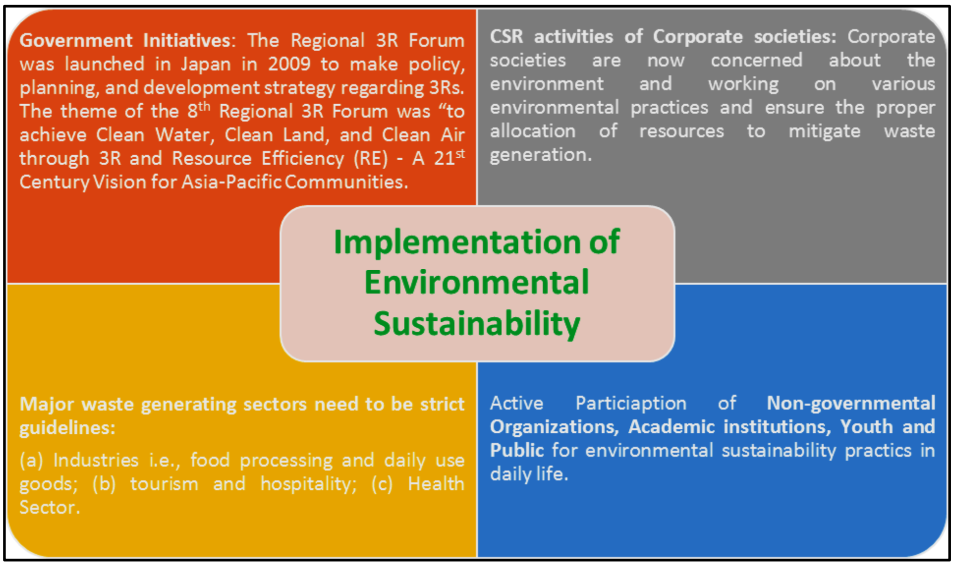

Figure 2.2: A summarized View of Implementation of Environmental Sustainability

Moreover, the Forest Act, 1927, Wild Life Protection Act, 1972, Clean Water (Prevention and control of Pollution) Act, 1972, Clean Air (Prevention and control of Pollution) Act, 1970, and The Environment (Protection) Act, 1986 were drafted to protect the environment and wildlife. The summarized view of Implementation of Environmental Sustainability is depicted in Figure 2.2 Policymakers of the corporate units, industrial sectors, and service providers have played an imperative role to adopt a standard protocol for any operation and service. If the government offers a tax credit system for green work culture or processing units, regular eco-assessments, and spread campaigns regarding the same, could encourage the adoption of the 3Rs strategy among commercial units or service providers.

2.3 Conclusion:

The 3Rs inculcate the introduction of sustainable practices in every sector that produces and releases waste or effluent to the ecosystem. Environmental could be protected by the development of sustainable practices and by efficient resource utilization. The sustainable economic growth model needs to be bridged with the circular economy.

The government also enforces the corporate sector to follow the guidelines recommended to maintain the environmental sustainability. Hence, the industries are getting aware of the effective utilization of energy and water with minimum waste generation using eco-friendly strategies. The recovery, remanufacturing, and redesign of products are the extended version of 3Rs.

The strict implementation of the 3Rs strategy is crucial for tourism and hospitality, manufacturing units, and municipality waste processing units because these are the key players to generate plenty of wastes that could be reused and recycled effectively.

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