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Indoor gardening for aesthetic and healthy life style

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Abstract

Due to increasing urbanization and industrialization, the major concern of all authorities are to find out the best way to get rid of outdoor as well as indoor air pollution problem. However, for outdoor air pollution, most of the efforts have been done to control but now much attention is needed to control indoor air pollution as contaminants are usually high in indoor places. Public health is a major issue due to indoor air pollution and indoor environment because most of the people in urban area spend more time inside as compared to outside. So, indoor plants and indoor gardening would be a better way to eradicate the emission of pollutants inside as well to make the indoor environment more lively and aesthetic. This review is mainly focusing on the indoor air pollution, its cause and how to improve the quality of indoor air by using indoor plants.

Keywords: Indoor plants, air pollution, happy minds, aquascaping and pollutants

Introduction

We all know that plants are an essential part of life as they provide us many things like food, fiber, fuel, pharmaceuticals and building materials. Moreover they are used to decorate homes from both inside and outside and also use to mark special occasions as in our culture, plants has many spiritual values and man is born with these, live with these and finally dies with these. Around the world people used to grow plants in containers and keep those containers in their living rooms and plants has been considered beneficial to people, socially, physically and mentally since thousand of years. Recently, it has been observed that working in garden makes feel better to the people. It has been seen that plants are useful to solve both environmental and health problems.

Now-a-days, due to more construction and changes in recent life style, people spend 80-90% of the lives indoor and because of this, modern cities faces a number of health problems and societal challenges *viz.* urbanization, climatic changes, ecological issues, environmental quality and sustainable development (Raymond *et al.*, 2017) [40]. Living style of urban people is linked with many negative influences on the health of humans e.g. due to environmental pollutants such as nitrogen and carbon dioxide, heavy metals, radionucleus, benzene etc. Various health issues are associated with these pollutants such as stroke, cardio-vascular problems, lung cancer, and both chronic and acute respiratory illnesses, headaches and dizziness, disruption of reproductive and immune systems, and premature death etc. Hence, the biggest issue of 21st century is promoting the health of urban population (Marcel *et al.*, 2019) [27]. The fictions of urban landscape and livable city have gained a new importance as an area of integration and balanced interaction of processes of urban development, natural and cultural contexts and challenges of making favorable environment for urban cities. In the form of urban gardening, a contact with nature, activities of sports and community gardens increase the satisfaction of life, psychological well being, social inclusion and adhesion, community sense and cognitive function (Soga and Gaston, 2016) [44].

Engage in natural activities is not only a cost-effective invention of health and a type of nature-based solution (Dushkova and Haase, 2020) [13]. But also as a preventive measure for various physiological and mental health problems, so called therapeutic gardening and healing garden therapy (Wood *et al.*, 2016) [55].

The practice of designing, arranging and caring for living plants under enclosed environment is called interiorscaping. The goal behind this, is to create a pleasing interiorscape (harmonious and aesthetically) which will perform satisfactorily with regards to post harvest life and quality of plant and plant care. In today's life, people spend most of the time indoors each day. Thus, it is necessary to have a comfortable indoor with favorable air quality. Roughly 27 million office workers are at risk of sick building syndrome even in United States (Lu *et al.*, 2016) [24].

Besides this, the indoor air pollution is generally 3-5 times (can extend upto 100 times) worse than the outdoor air pollution. People experiencing severe physical and mental health along with declining general wellbeing and this may be the reason behind this. To physical and mental health, nature exposure is considered best. As plants represents nature, so to improve the quality of living environment, people often used to grow plants indoor. It is also reported that the presence of plants has a beneficial impact on minimizing short term sickness absence as compared to the plants absence. Plants are considered as the most common element of nature and also regarded as the nature’s representative, even within a manmade structures, it is true.

According to World Health organization by 2020, the diseases that will deserve most of the attention in the world are cardiovascular disease, AIDS and depression. The disease that cause the highest disability to human and the second largest burden of society is depression (WHO, 2001) [3]. The medical expenditure and human resources both will be benefited, if mental health can be improved by plants. And they can

contribute to both public health and sustainable development, as plants consume little energy, slows down the global warming and contribute to diversity of ecology. As our lives are becoming more high-tech, we need to achieve more natural balance. The connection of mind, body and nature will increase physical and mental health. Use of both modern technology and experience of nature extends our intelligence, thinking of creativity and productivity and finally gives birth to hybrid mind. So, designing our homes, workplaces, neighborhoods and towns (interior landscaping) will not only conserve watts but also develop human energy.

- **Indoor air pollutants:** Every single source’s importance depends upon the amount of emmission of air pollutant, pollutant’s affect and the system of ventilation (i.e., general or local) to remove the contaminant. The age and maintenance history of the source are significant in some cases. However there are various indoor air pollutants which can be spread through a building, they typically fall into three basic categories: biological, chemical, and particle (Osha methods, 2003) [51].

Biological	Chemical (gases and vapors)	Particle (Non-Biological)
Through inadequate maintenance and housekeeping, water spills, inadequate humidity control, condensation, or water intrusion through leaks in the building envelope or flooding, there is an occurrence of excessive concentration of bacteria, fungi, dust mites, animal dander and pollen	The products used in building such as office equipment, furniture, wall and floor coverings, pesticides and cleaning and consumer products, accidental spills of chemicals, products used during construction activities such as adhesives and paints, and gases such as carbon monoxide, formaldehyde, and nitrogen dioxide, all are the sources.	These are solids or liquids, non-biological substances which are light enough to be suspended in air. Despite this, there are other activities in the buildings such as construction, sanding wood or drywall, printing, copying and other operating equipments are the sources from which they can be produced.

According to Osha, 2011; sources of indoor air pollution may include:

- **Site or location of building:** Nearby buildings, highways or buses may be the reason of air pollutant or particulates. Leaching of water and chemicals may occur in the building cited on land where there was industrial use prior.
- **Building design:** Indoor air pollution may occur by design and construction flaws. Pollutants or water intrusion may occur by poor foundations, roofs, facades, window and door openings. The constant source of pollutants may come by the outside air intake placed near sources where pollutants drawn back into buildings (e.g., idling vehicles, products of combustion, waste containers, etc.). Those buildings which has multiple tenants may need to ensure the emission of one tenant do not adversely affect the other tenant.
- **Renovation Activities:** During the renovation activities, the source of pollutants that may circulate through the building are dust or other by-products. These

contaminations can be removed by barrier isolation and by increasing the ventilation to dilute.

- **Building Materials:** Indoor air pollution can be contributed by disturbing the thermal insulation or sprayed on acoustical material or the presence of wet or damp structural surfaces.
- **Local Exhaust Ventilation:** In the deficit of adequate local exhaust ventilation, there are some areas which may contribute to the source of indoor air pollution and the places are Kitchens, laboratories, maintenance shops, parking garages, beauty and nail salons, toilet rooms, trash rooms, soiled laundry rooms, locker rooms, copy rooms and other specialized areas.
- **Building Furnishings:** Indoor air pollutants may release from the cabinetry or furniture made of certain pressed-wood products.
- Sources and effect of indoor air pollutant has been summarized in table 1.

Table 1: Sources and effects of indoor pollutants on human health

S. No.	Pollutant	Sources	Effects	References
1.	Carbon monoxide	Incomplete combustion of organic compounds, house fires, incomplete combustion of fuels (e.g., fuel gas, charcoal, etroleum) using a burner, heating or cooking equipment with insufficient ventilation or improper maintenance	Interferes with the ability of blood to carry oxygen to the heart, brain and other tissues. headaches, fatigue.	Kinoshita, 2020 [20]
2.	Particulate matter	Cleaning, tobacco combustion, fumes from cooking oils and fuel.	Personal Discomfort increases. Different lung and cardiovascular disorders.	Patel <i>et al.</i> , 2020 [35]
3.	Tricholoethene	Paints, Furniture and Building material, fabricated metals and adhesive solvents.	Immune and Reproductive system, liver, kidney, CNS effects, foetal development may also effect during pregnancy.	Jeanie, 2009

4.	Hydrocarbons	Combustion of fuel.	Causes various problems like Nervous System failure, cancer, tumor etc.	Al-Harbi <i>et al.</i> , 2020 [3]
5.	Benzene	Synthetic fibers, Inks, Plastics, tobacco smoke, detergents and oils.	Inflammation, drying and skin blistering, carcinogenic, headache, weakness, blurred vision, respiratory diseases, heartbeat, unconsciousness, psychological disturbances, anaemia and bone marrow, prarlysis etc.	Wolverton <i>et al.</i> , 1989 [54]; Heydari <i>et al.</i> , 2020 [16]
6.	Formaldehyde	Plywood, board, particle, insulation of foam, carpeting, clothes, furniture, paper goods, furniture and household cleaners.	Upper respiratory tract and eyes irritation. Throat cancer, skin rash, Asthma and Headaches.	Yu <i>et al.</i> , 2020 [58] and Sharma <i>et al.</i> , 2019 [42]
7.	Sulphur Oxides	Combustion of coal.	Skin lesions, problems related to breathing, headache, immunity decreases and cancer.	Tran <i>et al.</i> , 2020 [48]
8.	Aldehydes	Cooking, furnishing and construction materials.	Immunity decreases, Headache, Breathing problem and cancer.	Szabados <i>et al.</i> , 2021 [46]
9.	Ozone	Printers and photocopier.	Throat irritation, pain, chest burning or discomfort, coughing, breath shortness and wheezing.	Abbass, 2017 [1] and WHO, 2010
10.	Nitrogen oxides	Combustion of fuel.	Pulmonary diseases, lung infection impairment, eyes, nose and throat irritation, infection susceptibility increases	Susanto <i>et al.</i> , 2021 [45]
11.	Radon	Construction material, soil under building	By smoking, lung cancer risk increases, miners cancer, leukemia.	Slezakova <i>et al.</i> , 2012 [43]
12.	Lead	Painted surfaces wear, soil, water, cosmetics and costume jewelry	Brain attack and central nervous system to cause coma.	Debnath <i>et al.</i> , 2019 [11]
13.	Fluorine and arsenic	Combustion of coal	Skin lesions, hyperkeratosis, cramping of muscle and death.	WHO, 2010
14.	Biological pollutants	Furnishings, cooking and construction material	Allergy may cause. Situation of hypersensitive occur.	Slezakova <i>et al.</i> , 2012 [43]

Benefits of indoor plants: (Mrinalini, 2018) [32]

- **Indoor air quality improvement:** Distance between people and nature becomes more due to rapid industrialization and urbanization. Human beings carry a part of nature with them in every place where they live and they can be in any forms such as a small garden or in the form of houseplant (Cetin, 2015 and Sevik, 2016 [8]). All kinds of air pollution can be reduced by indoor plants and also give other benefits such as increase productivity, psychologically relieve people, and decreases stress and negative feelings. As we know that when we take breathe, a process takes place in which taking of oxygen and exhaling of carbon dioxide happens and the plants do just opposite to humans during photosynthesis which leads to the cooperation of humans and plants. One of the influential way to reduce the level of CO₂ is ventilation

because outdoor air can be 5-100 times more clear than indoor air (Bulgurcu, 2006) [5]. Plants are very essential part of human's life as they provide food, improve indoor air quality etc. and all these processes are done by leaves only. Some commonly known foliage plants helps in reducing the levels of some interior pollutants, including formaldehyde and carbon monoxide. Due to bacteria growing on roots of plant, these plants reduce pollution at higher rates. It has shown that plants remove other indoor air pollutants including ozone, toluene and benzene (Papinchak *et al.*, 2009) [34]. Based on the various studies, the work of many building industries was dismissed because of the small controlled chambers. Subsequently, a biofiltration unit with an aquarium and interior plants that can effectively maintain healthy indoor air was introduced (Darlington *et al.*, 2001) [10].

Table 2: Indoor plant that eradicate indoor air pollutant is enlisted in

Sr. No.	Plant	Eradicated pollutants	References
1.	<i>Chlorophytum comosum</i> (Spider plant)	Hydrocarbon, Formaldehyde, ozone, Toulene and xylene.	Papinchak, 2009 [34] and Inbathamizh, <i>et al.</i> , 2020 [17]
2.	<i>Dieffenbachia spp.</i> (Dumb Canes)	Xylene and toulene, hydrocarbon	Abbass <i>et al.</i> , 2017 [1]
3.	<i>Aloe vera</i>	Formaldehyde, benzene and xylene	Inbathamizh, <i>et al.</i> , 2020 [17] and Sharma <i>et al.</i> , 2019 [42]
4.	<i>Chrysanthemum morifolium</i> (Florist's chrysanthemum)	Ammonia, benzene, trichloroethylene, toulene and xylene, formaldehyde	Sharma <i>et al.</i> , 2019 [42]
5.	<i>Sansevieria trifascata</i> "Laurentii"	Toulene and xylene, trichloroethylene, formaldehyde, ozone and benzene	Papinchak, 2009 [34] and Sharma <i>et al.</i> , 2019 [42]
6.	<i>Spathiphyllum wallisii</i> (peace lily)	Hydrocarbon, ammonia, benzene, toulene and xylene, formaldehyde and trichloroethylene	Yoo <i>et al.</i> , 2006; Wood <i>et al.</i> , 2006 [52] and Abbass <i>et al.</i> , 2017 [1]
7.	<i>Dypis lutescens</i> (Areca palm)	Formaldehyde, xylene and toulene	Kobayashi <i>et al.</i> , 2007; Pottorf, 2010 [38] and Inbathamizh <i>et al.</i> , 2020 [17]
8.	<i>Anthurium andreaeanum</i> (Flamingo lily)	Formaldehyde, xylene and toulene, hydrocarbon and ammonia	Han ans Ruan <i>et al.</i> , 2020 [15]

9.	<i>Nephrolepis exalata</i> (Boston fern)	Toulene and xylene, formaldehyde	Chaipong, 2020 ^[9]
10.	<i>Ficus elastic</i> (Rubber plant)	Formaaldehyde	Corneio,1999 ^[7] ; Abbass <i>et al.</i> , 2017 ^[1] and Han and Ruan <i>et al.</i> , 2020 ^[15]
11.	<i>Philodendron cordatum</i> (Heartleaf philodendron)	Hydrocarbon and formaldehyde	Pottorff, 2010 ^[38] and Chaipong, 2020 ^[9]
12.	<i>Hedera helix</i> (English ivy)	Ammonia, hydrocarbon, xylene and toulene, formaldehyde and benzene	Yoo <i>et al.</i> , 2006 ^[57] and Inbathamizh, <i>et al.</i> , 2020 ^[17]
13.	<i>Gerbera jamesonii</i> (Barberton daisy)	Trichloroethylene, formaldehyde and benzene	Pottorff, 2010 ^[38] and Sharma <i>et al.</i> , 2019 ^[42]
14.	<i>Dendrobium spp.</i>	Xylene and toulene	Han and Ruan <i>et al.</i> , 2020 ^[15]
15.	<i>Bamboo palm</i>	Toluene, benzene and formaldehyde	Inbathamizh, <i>et al.</i> , 2020 ^[17]

- **Happy minds and illness:** It is usually said that in the morning, walking on a grass with barefoot is very beneficial for eyes. Plants perform transpiration in outdoors which is said to account 10% of the atmosphere moisture. And specially for dry months, the humidity can be increased by transpiration which results in decreasing various problems such as dry skin, cold, sore throats and dry coughs etc. Seeing live green plant around and working with plants makes mind happy (Thaneshwari *et al.*, 2018) ^[47].
- **Healing mentally and physically:** Plants can be useful in lowering down the pain, anxiety and fatigue. And somewhere in abroad, horticulture therapy is provided to the patients, in which patients take care of plants. As a physical therapy o horticultural programmes, therapeutic gardens are a type of healing gardens. Therapeutic gardens are mainly used for the patients suffering from metal illness (Thaneshwari *et al.*, 2018) ^[47].
- **Nature sustainability:** Urban areas have very less vegetation and because of this, they experience a severe temperature. As much as 12%, properly planted indoor plants can cut heating and cooling cost and also minimizes the demands of power. The most common element of nature and often regarded as the most representative of nature is plant and even in manmade structures, this is true. The plants in a room differs from the outdoor environment (Bringslimark, 2009) ^[4]. The dynamic interrelationship between thermal comfort needs, chemical factors, physical and biological factors is indoor environment.
- The beneficial effect of cooling can be provided by building surfaces covered with plant as plant absorb a considerable amount of solar radiation for the growth and biological function (Kontoleon and Eumorfopoulou, 2010) ^[22]. To minimize the load of cooling and to reduce the use of air conditioning, during summers, indoor plants would be beneficial.
- **Relative humidity:** It was reported that relative humidity can be raised to healthier and more comfortable levels by foliage plants. The humidity range below 30% to 60% recommended for human comfort. Frequent cold, wood dries and cracks occurs when indoor relative humidity is too low. Too much relative humidity can be increased by interior plants. Rise in relative humidity slows down the loss of water because water does not evaporate as rapidly at high humidity. Humidity should be maintained at optimum level. As low humidity leads to the low levels of biological contamination and thus the environment can also be secured (Moon., 2015) ^[31]. It is difficult to maintain the optimum level during summers, without conditioning systems and these consumes high energy so use of indoor plants would be beneficial and unexpensive method (Fernandez-Can ero *et al.*, 2012) ^[14].
- **Particulate matter:** Particulate matter deposition can be reduced (as much as 20%) by adding plants to the periphery of the room or can be reduced to many meters by adding plants in the center of the room. In self watering pots or containers, watering is done from the bottom of the pot and growing medium actually an interior dustier. The key pollutant from health and environmental perspectives both indoor and outdoor is particulate matter. Various hazardous health outcomes are associated with the exposure to particulate matter. Various adverse diseases associated with it are chronic obstructive pulmonary disease, cardiovascular disease and asthma (Patel *et al.*,2018 and Li *et al.*, 2003) ^[36, 23].
- **Indoor temperature:** The indoor building environment consists of two primary variables *viz.* indoor temperature and indoor relative humidity. The combination of the radiations received from the walls and roof of building is indoor temperature. Building is said to be thermally uncomfortable, if the indoor temperature is either too high or too low (Ponni, 2015) ^[37]. As like relative humidity, various diseases results due to temperature. The room temperature also affects the concentration level of the occupant (Tham, 2008) ^[49]. For building energy and for urban microclimate mitigation, green roofs, green facades and living wall can be valuable. During summers, the main radiant and the indoor air temperatures can be minimized by the use of green walls (Djedjig *et al.*, 2017) ^[12].
- **Well being**
- **Feelings:** It was reported that presence of plants in the room brings positive vibes to the humans. Most of the people feel attentive and concentrating in the presence of plants (Lohr *et al.*, 1996) ^[26]. And feeling of more carefree or playful and friendly of affectionate was observed in the presence of plants. People working in office feels very happy with plants. According to the Ministry of Health, Labour and Welfare in 2016 ^[29], it was revealed that work-related issues in nearly 59.5% employees might occur due to high stress level, distress and anxiety (Ministry of Health, Labour and Welfare, 2017a) ^[30].
- **Reduce stress:** It has been observed that most of the people recover from stress more quickly by viewing slides or videotapes of nature than viewing urban scene images (Ulrich, 1981). Stress reducing responses were also observed even when their attention is not drawn to plants. Even nature's images can be helpful in reducing stress. Productivity can also be increased by plants because in the presence of plants, reaction time is 12% faster than in the absence of plants. The students are less

mentally fatigue by seeing out over nature from the classrooms. Although in other case study, it was concluded that to reduce the stress related condition, small indoor plants could be helpful and economical for business owners (Toyoda *et al.*, 2020) [50].

- **Plants and living art for Interiorscaping:** There are different types of house plants that we can use as a indoor plant to make air quality pre and fresh and these are classified into various groups. The various groups with suitable plants belonging to each group are mentioned below (Randhawa and Mukhopadhyay, 1998) [39];
- **Climbing and Trailing Foliage plants:** These type of plants need support for growing and for that, various types of supporting materials are used such as split bamboo can, creeper or a trailer etc. and for screen making, thin chicken wire mesh may be used supported on wire frame. Some plants suitable for this group are as follows;
 - **Climber:** For hanging baskets, the beautiful variegated creepers are *Ficus pumila* and *Ficus radicans* variegata. The creamy white variegation begins from margins, *Syngonium podophyllum*, *Philodendron elegans*, *Asparagus plumosus*, *Hedera helix* etc.
 - **Trailers:** Suitable species of plants for this groups is *Chlorophytum comosum variegatum*, *Tradescantia fluminensis*, *Zebrina pendula*, *Zebrina purpusii* etc.
- **Bushy and upright foliage plants:** Usually, the plants belonging to this group possess beautiful foliage and are suitable for arrangements as well as individual specimen. Plants suitable for this group are *aspidistra lurida*, *Begonia 'Rex'*, *Dieffenbachia exotica*, *Codiaeum* (crotons), *Philodendron bipinnatifidum*, *sansevieria*, *Grevillea robusta* etc. However, *Araucaria excelsa* and *Brassaia actinophylla* does not come under the category of foliage plants but they can be used until they grow up.
- **Flowering House plants:** Usually these type of plants have attractive foliage and beautiful flowers which remains on the plant all the year. They are;
 - **Climbing as training type:** *Begonia glaucophylla*, *Begonia glabra*, *Passiflora caerulea*, *Trachelospermum jaminoides*.
 - **Bushy and upright types:** *Aphelandra squarrosa*, *Begonia maculate*, *Begonia manocata*, *Saintpaulia ionantha*.
- **Flowering pot plants:** Any pot plant which require partial shade for their growth can be grown as indoor plant and the suitable plants belongs to this group are *Azalea indica*, tuberous rooted begonias, chrysanthemums, *Coleus*, *Pelargoniums* (geranium) etc.
- **Bulbs:** Usually the bulbs can be grown indoor for once, after that they are to be planted outdoor. Special bulb bowls and bulb fibre are use to grow bulbs. After flowering the annual bulbs exhaust themselves and then removed for outdoor culture.
 - **Annual bulbs:** Most of the annual bulbs are suitable for temperate regions only. Suitable bulb are daffodils (*Narcissus*), *Crocus*, *hyacinths* and *Tulips*.
 - **Permanent bulbs:** The only bulb plant which grows well indoor and which can be grown under tropics is *Amaryllis* (*Hippeastrum*).
- **Ferns and palms:** Various palms and ferns are suitable for indoor gardening.
 - **Suitable ferns:** *Nephrolepis exalata*, *Pteris cretica*,

different species of *Selaginella* (not a fern but still used) etc.

- **Suitable palms:** *Cycas revolute* (look like palm but not a palm), *Chamaerops humilis* and *Phoenix roebelenii* etc.
- **Rose for indoors:** We can grow rose under indoor condition by providing the suitable conditions. The cultivars all Gold, Lilac charm, Red wonder do well under indoor condition.
- **Cacti and succulents:** Under indoor conditions, epiphytic types which require less light do well. Some suitable species are *Agave americana marginata*, *aloe variegata* with some other species, *Opuntia microdasys* and various species of *sedum* etc.

Some epiphytic cacti such as *Aporocactus flageliformis*, *Epiphyllum* species, *zygoplants*.

- **Miniature plants or bonsai:** The art of growing plants to a miniature from having a natural look of old age. It requires special types of containers. For indoor decorations, bonsai are very good. Their architectural shapes are attractive enough for decorative display, when they are deficient of leaves. Suitable plants are various species of *figus*, *bougainvillea*, *hamelia patens*, *juniper*, *jackaranda*, *mango*, *pine*, *neem*, *tamarind*, *mango*, *karonda*, *duranta gold* etc.
- **Terrariums:** A small garden inside a closed glass or a plastic container is called terrarium. To grow a collection of small plants, it is a delightful way. Those plants which are difficult to grow in normal dry atmosphere of our homes, under proper care, terrarium create a humid atmosphere that protects tender plants. Suitable plants for terrarium are:
 - **Tall plants:** *Syngonium podophyllum*, *Pilea microphylla*, *Asparagus spp.*, *Begonia spp.*, *Dracaena sanderiana*, *Codiaeum variegatum*, *Dracaena surculosa* etc.
 - **Short, rounded plants:** *Begonia Rex*, *Cryptanthus spp.*, *Asplenium nidus*, *Tetranema roseum*, *Pelargonium spp.*, *Ophiopogon japonicas*, *Peperomia spp.*, *Hypoestes phyllostachya*, *Sansevieria trifasciata*
 - **Short, Prostrate plants:** *Ficus pumila*, *Columnnea microphylla*, *Hedera helix cvs*, *Plectranthus spp.*, *Selaginella spp.*, *Philodendron spp.*, *Herniaria glabra*.
- **Bottle gardens:** For indoor decorations, bottle gardens have got an enormous immense. These gardens brought beauty into the rooms. A London physician named Nathaniel ward developed the idea of this garden. It requires much attention to construct. It has fascinating beauty and so, can be used for table decoration inside room. Suitable plants are *Fittonia*, dwarf varieties of *Aglaonema*, *Ferns*, *Cryptanthus* etc.
- **Dish garden:** For growing plants, commonly used materials are both glazed and earthenware dishes or bowls. The dishes must have holes at the bottom for drainage of water and should be about 10cm deep. The size of the dishes should be not too large. To create a fantastic container gardens, succulents can be combined with shells, bits of glass and other objects. Suitable plants are flowering cactus like *Heliocereus*, *Brozicactus*, *Rebutia*, *Lobivia*, *Notocactus*, *Mammillaria*, *echinopsis* and *Paradia*.
- **Aquascaping:** The craft of arranging aquatic plants as well as stones, cave-work, driftwood or rocks in an aesthetic manner within aquarium is called aquascaping (Martin *et al.*, 2013). For enhancing the aesthetic look,

various shades of plants along with green can be use in it but red and orange colour leaves make it excellent. Besides olants of different shape, size and colour, the one which are heart and soul of aquarium is fish. Suitable plants for aquascping are Dwarf Baby Tears (*Hemianthus callitrichoides*), *Rotala Green*, Christmas Moss (Xmas moss), needle Leaf java Fern (*Microsorium pteropus* marrow) and *Salvinia auriculata* etc.

- **Plants suitable for different indoor environmental condition:** Indoor environmental conditions varies on the basis of temperature, humidity and light. Although plants adapt to various environmental conditions but different plants require different conditions for their optimum growth and development. Various combinations of light, temperature and humidity with the intensity of low (L), medium (M) and high (H) with suitable species are as follows:
 - **Service area** (MHH, MMM, MMH): Kitchen (a service area in home) is a place where humidity and temperature varies greatly in every situation. Humidity and temperature is likely to be rise when it is in use and decreases when it is not being used. There are various plants which can be used to maintain these, as it is one of the place where much care is needed, tall or big plants might be inconvenient for such places. Plants which are appropriate and functional can be planted in this place viz. Celery, Mint, Thyme and Parsley.
 - **Private area** (includes both bed room and bath room):
 - **Bath room** (MMH, LMH, LLH, LMM): Humidity is maximum here when it is in use, light is mainly low and medium to low temperature. Plants that can tolerate high humidity and low light can be planted in this area and those plants are: *Asplenium nidus* (bird nest fern), *Nephrolepis sp.*, *Scindapsus aureus* (pothos), *Philodendrons scandens* and *Cissus repens*.
 - **Bed room** (MMM, MML, HML): In this area, temperature is always optimum or medium, light is medium to high, and humidity is medium to low. Plants like *Chlorophytum* can be used here as they have the ability to remove pollutants like formaldehyde from cloths, and which in turn act as an air cleaner. Suitable plants to this category are: *Clivia miniata*, *Cyclamen persicum*, *Spathiphyllum* 'Mauna Loa' and *Chlorophytum comosum*.
 - **Public area** (MMM, HMM, MML): The place where the public or guests spend time with the family. The plants that can be suitable for this place are those which has having showy, large or colourful plants. Usually, this area has high to medium light, medium to low humidity and medium temperature. Various Appropriate plants suitable for this condition are: *Scindapsus aureus* (pothos), *Spathiphyllum* 'Mauna Loa' (Peace Lily), *Ficus pandurata*, *Hedera helix* and *Begonia semperflorence* (English ivy).
 - **Family living area** (MMM, HML, MML): The area where all the family members meet and spend quality time together. Usually this area has medium to high light, low to medium humidity and medium temperature. The appropriate plants are: *Chamaedorea seifritzii* (Bamboo palm), *Philodendron scandens*, *Chlorophytum* (Spider Plant) and *Spathiphyllum sp.* (Peace Lily).

Future Aspect: Indoor air pollution will become a major problem for future generation unless or until population is

controlled which is increasing at very fast rate. It is mandatory to wake up and take step against it as we all are aware about the various impacts of air pollution on both environment and human health. This problem will be more in highly populated countries like India, China, USA etc. Indoor air pollution need more attention because urban people are spending most of their time indoor. To increase the process of phytoremediation, transgenic indoor plants should be develop at fast pace. For the emission of particular pollutant, guidelines would be set in offices, buildings, houses and schools. Each and every individual need to do their part as a whole to get rid and fight air pollution. In order to maintain a heathy and aesthetic life style in urban area, art of indoor gardening with ornamental as well as herbal indoor plants need to be promoted and implemented.

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