

Design and Planning of Pharmaceutical Industries in India

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Abstract: *In the field of pharmaceuticals modern trends are taking place. It became an essential factor to seek more advanced methods, to run the businesses. In India, though at a slower pace, the industry is gradually embracing the idea of advanced technologies. Rapid growth in India demands the urgent need of good factory planning. In modern days, a factory became a place of nicely laid out gardens and not just remain a place of dust, machinery & noise. This is needed not just from the point of aesthetics but also to keep the micro-climate intact.¹ Pharmaceutical industry design therefore demands specialized knowledge.*

Keywords: Industry, pharmaceuticals, design, circulation, function, movement, material

I. INTRODUCTION:

The factory design is a product of social, political, economic & personal relationship between people & national growth. It has been seen that the pharmaceutical industry is one that has its regulations and procedures upgraded constantly worldwide. Pharmaceutical industries have to follow the standards set by WHO (World Health Organisation). A pharmaceutical industry designed to international standards and suited to the moderate climate will help improve Indian pharmaceutical products and produce quality and efficacious medicinal products.ⁱⁱ

Pharmaceutical industry could be vaccine manufacturing, ayurvedic medicines manufacturing, capsules or ointment manufacturing industry. This particular study focuses on the study has of the planning of the vaccine manufacturing industry, which is one of the categories of pharmaceutical industry. A challenge of the study is to encounter the design that suit in the moderate climate. Most of the information related to study was gathered with respect to circulation patterns and finishes. Another issue was that, the specific data on architectural components such as basic required spaces, spatial arrangement, services and lighting issues is needed. Special care should be taken during the planning of internal as well as external spaces of the campus, so that the circulation pattern shouldn't overlap & function shouldn't disturb still aesthetical values remain intact.

Beyond the mentioned issues, design should be taken care of following aspects like the kind of machinery and equipment need for manufacturing, security systems, control of parameters such as lighting, temperature, humidity, ventilation, maintenance schedules among others. These issues need to be conquering efficiently to keep the pace of progress successful. Designing of pharmaceutical industry demands a good understanding of how the industry runs and how best to ensure the production of efficacious and quality products. Again, the regulatory requirements for production facilities within the pharmaceutical industry are being continuously and incessantly tightened. It is imperative,

therefore that manufacturers be abreast with changes in the industry.

The aim of the thesis is to design an ideal vaccine manufacturing industry comprising of production, research and recreational activities to increase the quality of the product and its manufacturing process to consistently deliver the intended performance of the product as well as to create a user-friendly environment.

In the studies, the existing site conditions have been considered. Context has again the considerable values in this case. The study is restricted for the vaccine manufacturing type of pharmaceutical industry, since pharmaceuticals is a huge field. The climatic conditions do affect on the temperature and humidity that need to be controlled in the production area. So, the study restricted for the moderate climatic conditions only. According to the complexity of the project, the research is limited to internal layouts, furniture layouts and landscape as well as optimum services. The premises serve the function of production, research & recreation, but the permanent accommodations for the workers is not included as it might be harmful for human health.

METHODS & STUDIES:

Five cases are studied to draw certain observations & conclusions of ideal conditions for pharmaceutical industry design. Three of them are live case studies while remaining two are book case studies. Three live cases belong to Pune's context and climatic zone. Remaining two is the industries of international importance and belongs to different continent and climatic zones. Leading to the writing of this report, information was gathered by interviewing a variety of experts and professionals too. The basic and physical information collected by general observations. For the standards and by laws secondary data were used. It has been noted that in all the five cases services played important role.

-Services like water supply, water recycling plants, surface water drains & rain water harvesting plants can be seen in all the five cases, irrespective of their size and the amount of production happen.

-Among five, three cases gave importance to landscape and aesthetics while for remaining two, landscape and aesthetics were secondary criteria.

-None of these buildings were form oriented, since function preferred first. The spaces were non-organic in shape, simplified for circulation.

-Parking is efficiently must given aspect of the pharmaceutical industries.

-Materials used in the factories were as per the WHO (World Health Organisation) standards. The materials and finishes used in the industry was such that, it could be easily unable to

grow bacteria. No sharp edge or corners were left within the production area. In case of cold rooms stainless steel finishes were used. Walls, floors, and ceilings are to be constructed of smooth, cleanable surfaces, impervious to sanitizing solutions and resistant to chipping, flaking, and oxidizing.

-Circulation patterns in all the five cases are similar. In each case material and human movements are segregated. Circulation pattern follows the basic sequence, raw material entry-material segregation-store- production-filling-packing-dispatching. There are also quality control checks during production to ensure that the right parameters for particular products are met. After production, products are packaged and sent for storage.

-Other than this, the HVAC system was another important factor. While designing HVAC system, factors likes relative humidity, air exchange, room pressure differential, room temperature, return air duct locations, airflow patterns should be taken care of.

-Supply air outlets are provided to flush the air at the ceiling level with perforated stainless-steel grilles and terminal absolute filters. Return air grilles to be provided at the floor level with a return air riser for better scavenging.

To initiate the design, functional relationship diagrams were sketched to give an idea as to how the various blocks or units could possibly relate to each other in terms of activity patterns and movement patterns. One option was preferred and further developed into a conceptual site diagram relating it to the site. Due to the different activities that take place at the facility, there are different functional relationships for each unit.

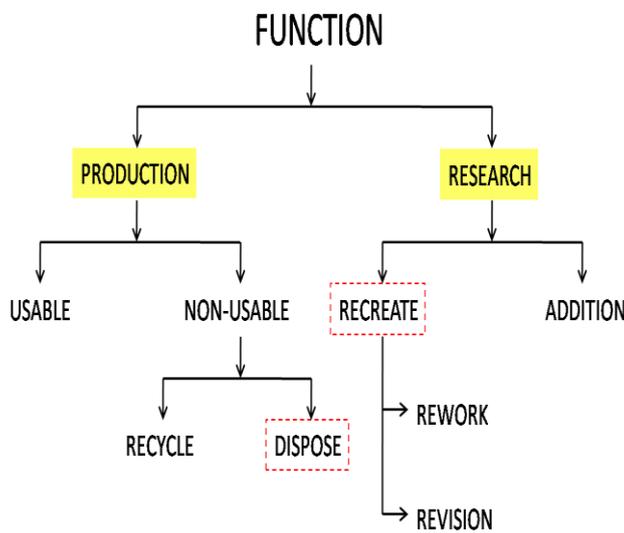


fig.1. flow chart of function & its outcome (source: author)

III. Results:

Concept: The design is evolved from the theory of a traditional Chinese symbol yin-yang. The symbol describes how seemingly opposite or contrary forces may actually be complementary, interconnected, and interdependent in the natural world, and how they may give rise to each other as they interrelate to one another.ⁱⁱⁱ

Table.1. spatial analysis of the spaces of pharmaceutical industry (source: author)

	Case 1	Case 2	Case 3	Case 4	Case 5
Production area	Y	Y	Y	Y	Y
Washing area	Y	Y	Y	Y	Y
Sterile area	Y	Y	Y	Y	Y
Cold room	Y	Y	Y	Y	Y
Incubators	Y	Y	Y	Y	Y
Packing area	Y	Y	Y	Y	Y
Dispatching	Y	Y	N	N	Y
Labeling	Y	N	N	N	N
Warehouse	Y	Y	Y	Y	Y
Laboratories	Y	Y	Y	Y	Y
Library	Y	N	N	N	N
Auditorium	Y	N	N	N	N
Administration	Y	Y	Y	Y	Y
Utility area	Y	Y	Y	Y	Y
Parking	Y	Y	Y	Y	Y
Canteen	Y	Y	Y	Y	Y
Conference room	Y	Y	Y	Y	Y
Guesthouse	Y	N	Y	N	N
Informal gathering space	Y	N	N	Y	N
mechanical rooms	Y	Y	Y	Y	Y
space for further extension	Y	N	Y	Y	Y
soak pit & septic tank	N	N	Y	N	N
effluent treatment plant	N	N	Y	N	N

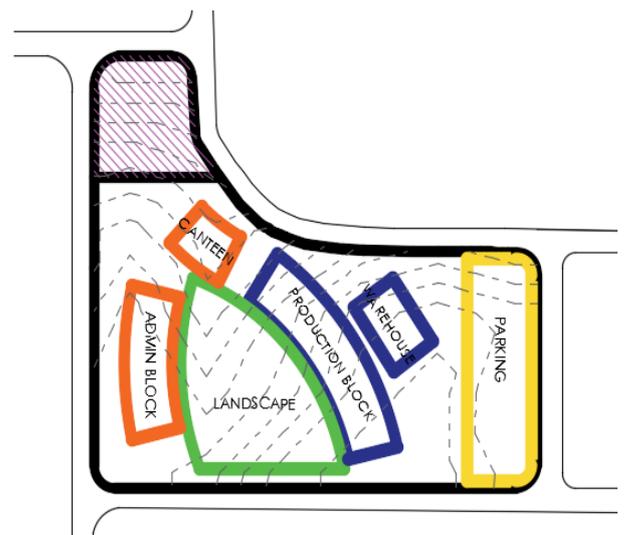


fig.2. stage 1 (source: author)

In the design, two opposite blocks (according to function) viz. production block which demands privacy, security & isolation while the administration block is accessible for all the visitors.

And this both entirely opposite buildings are the part of same premises.

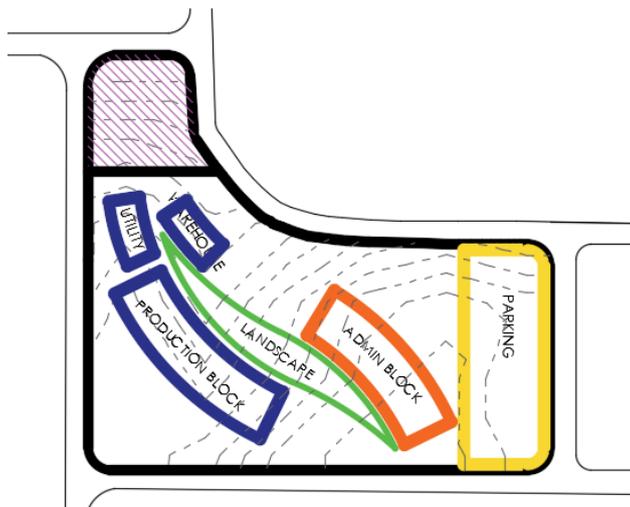


fig.3. stage 2 (source: author)

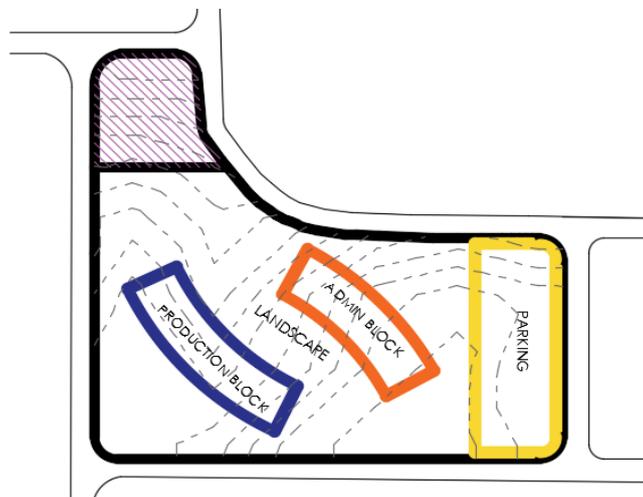
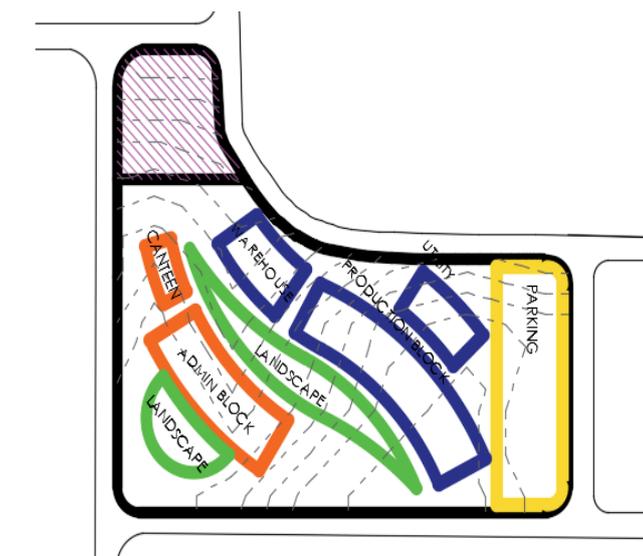


fig.4. stage 3 (source: author)



Design considerations & strategy:

1. Site topography:

Site has a context of Ramtekdi hill ranges. The slope is from south-west to north-east. Production building is located along slope. Equal cut & fill is happening in this case.

2. Climate & context:

Cleanroom design demands the high security. Direct contact with external environment is strictly prohibited due to the chances of contamination. So, the orientation doesn't matter since function is a primary need. But the spaces like admin building and canteen has an advantage of the surrounding. Under-ground water tank is located on higher side while the water recycling plant is on lower contour.

3. Sun Light:

Solar panels are provided over parking. It is acting both as shading devices as well as energy generator. Photo voltaic cells are cladded on the facade of the production building.

4. Water:

To cater the problem of water crises water recycling plant is provided which will be used for flushing and landscape.

5. Tree planting policy:

Preferably lawn, hard-landscape and shrubs are more suitable near production area and warehouse, since dense or flowering trees increases the chances of contamination due to presence of bird. Other public spaces and recreational spaces has an advantage of flowering or dense trees.

6. The general layout – There are 2 main entries into the site. One access way is for the staffs and visitors. The other entrance, which is service entry, leads to the warehouse and other services as well as parking.

There are four main structures on the site:

- administration and public unit
- warehouses
- production building
- canteen block

7. The warehouse- Raw materials are first quarantined for testing to ascertain the quality. Unacceptable materials are further disposed off. Accepted materials are sent to the main storage areas. Products are sent to the appropriate unit for processing.

8. Personnel Movement- Production personnel converge at a common concourse which has locker spaces for storage of hand held items like bags. Personnel then go to the changing areas to first take of their street clothing and then get into their work clothing. From the changing rooms they get to a common corridor and filter into their respective units.

9. Research Unit- Another independent unit is the research unit. Activities here have no direct link with production. Access to this unit is from the admin building to a reception and then to the lab, offices and ancillary facilities.

IV. CONCLUSION:

It is possible to play in shape and forms while keeping the function intact in the places like pharmaceutical industries. The aesthetics of the premises are equally important as the function and it could be well designed if considered at the initial stage of the design.

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