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Design and Analysis of Toilet Pan Structure Based on Their Efficiency

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Abstract:

Analysis of the different types of toilet pan structure for to reduce the use of Water. It is found that approximately forty percent of the world's population has access to flush toilets. There need 20 to 25 liters of drinking water to flush the toilet after use per day. Toilet bowls must be Water efficient .I.e. toilet bowls should be so designed that they may use very little water quantity (100 to 200ml) per flush. This may be achieved by changing the design of the toilet pan.

Keywords: *Toilet, Flush, Deification, Urination, Design water.*

I. Introduction

As a sanitation facility, the toilet pan is a civil engineering structure used by the human body to deify and urinate comfortably. Easily and safely inside the house, out-door, or any other places where ever required. Toilet pan is of two types 1. Squatting or Orissa pan 2.uropian or pedestal pan.

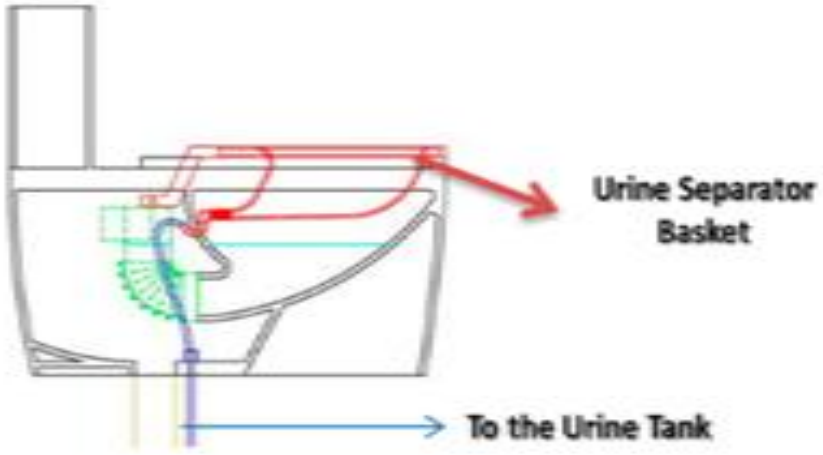


Fig: 1 Liter Water- Saving Toilet

Sanitation is a natural and essential part of human life, and it is an important concern for sustainable green and smart city planning. However, current sanitation practices are not sustainable. [1]

A national water use standard for high–efficient toilets was necessary to address the problems with different states and communities having established different toilet water use standards. A national standard eliminated the need for plumbing fixture firms to manufacture stock and deliver different products and the difficulty for states in preventing the importation of high water use fixtures. [3]

The vehicle-mounted vacuum toilet system found in coach buses uses a vacuum to suck fecal sewage from the toilet bowl into a fecal sewage collecting box. [4]

Toilets are essential elements that represent a significant percentage of the water consumption in the domestic sector. Any improvement in these devices signifies an important reduction in the water demand. [10]

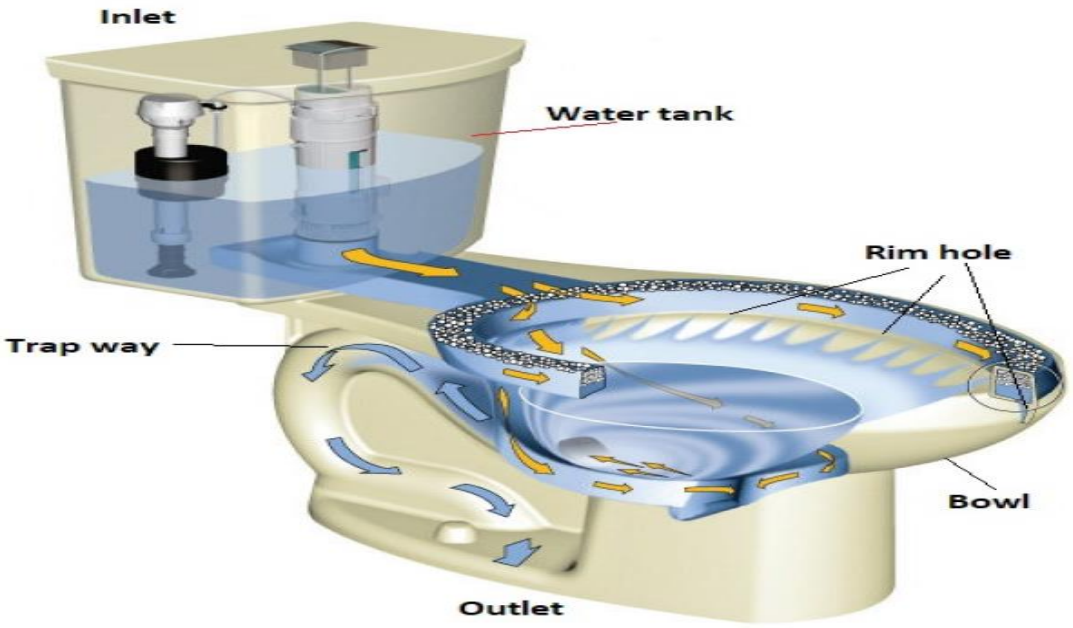


Fig: 2 A simple symphonic toilet

Wasting Water in toilets flushing is the largest water wasting source through the use of old siphon boxes. It occupies the first place in domestic consumption. Two trial approaches for optimizing the flushing system design. The first one employs a rotatable blade in the bottom of the Bowl. This blade pushes materials in the Bowl to cross the trap way thus;, less toilet flushing water can be used. The second approach depends on using a rotatable trap to be titled down to enable discharging materials in the Bowl directly by its gravity. [6]

Water-saving devices (WDSs) sustain demands for portable Water, soften impacts on supply systems and inflict a positive effect on wastewater treatment systems. This study evaluated the effect of some WSDs in Oman. A questionnaire survey and some case studies were used. The survey results revealed that the pipeline system network for Water supply accounted for about 67.7%, whereas the rest mainly use tankers. [12]

II. Squatting Pan

A squatting pan is also known as eastern style water [9] pan, or Orissa's pan; an Indian plumber from Pattamundai, Kendra Para Orissa, had designed this type of toilet .it is used by squatting, i.e., bending down with knees and full support is given to the ground level. It can be flushed manually or by cistern attached with the pan.

III. Pedestal Toilet Pan

EWC is designed to sit in a toilet. [6] This type of toilet comes with a cover and flushing [7] tank. The flush tank may be made of plastic or ceramic. A water seal is made of 50mm water retained, which will protect the smell coming from the toilet pan. It is made of 500mm to 550mm ht. The weight of the pan may be 12 kg to 20 kg. It may stand a minimum weight of 400kg. According to the trap design, it may be classified first one is S Trap Type another one is P Trap Type. It may be classified according to the mounting system first one is Floor Mounts Type another one is Wall Hung Type. Based on the trap's visibility, it may be classified as the first one is Concealed Trap Way Type and another Visible Trap Way Type.

IV. The structure of the toilet

A toilet pan is designed so that the human body can urinate and deficient comfortably, keeping in mind the comfort during utilization the toilet pan is associated with toilet seat ,cistern ,pedestal support .to know the toilet pan structure we may look the diagram drown below.

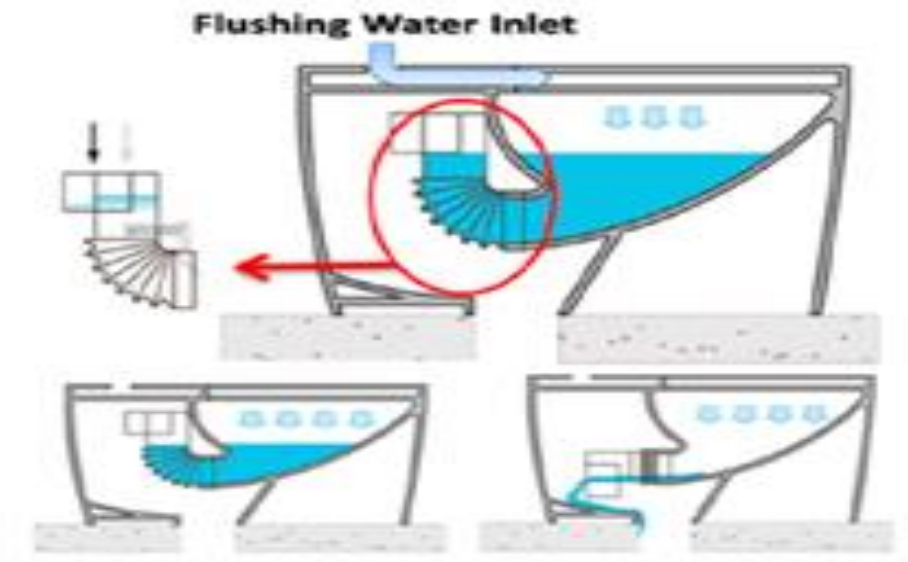


Fig: 3 Urine Source Separator Basket

A. Base:
The base of a toilet pan is the bottom part of the structure, which comes in contact with the floor or wall (wall mounted). It holds the pan correctly during its use and transfers a load of the user to the ground. The base is fixed with the floor by screws.

B. Stand:
The stand is the middle part of the toilet pan. A suitable height is maintained for the comfort of users .this part also functions for flushing space in the toilet.

C. Bowl:
The Bowl of a toilet pan works to collect human scrota during deification or urination. It also functions as a cleaning space during the flush.

Water flow analysis study is performed, leading to a toilet bowl satisfying, simultaneously, functionality, design, and present standard requirements. [2]

D. Trap:
It is a part of a pan connected with a sewer line for the disposal of excreta. Trap also protects bad smell entry from the sewer to the toilet room. It works as a water seal.

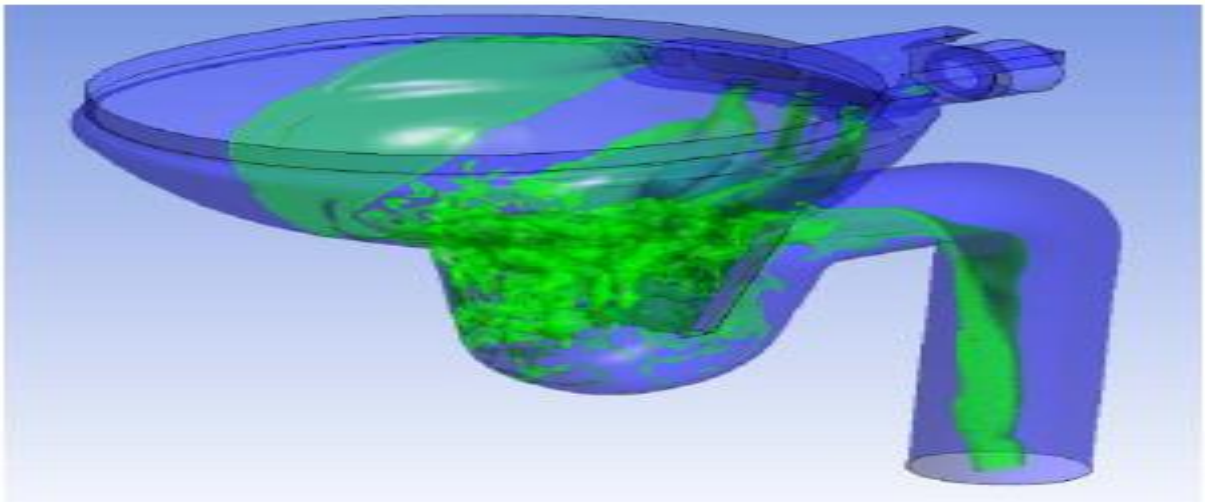


Fig: 4 Water flow in the Bowl

E. Wax ring:

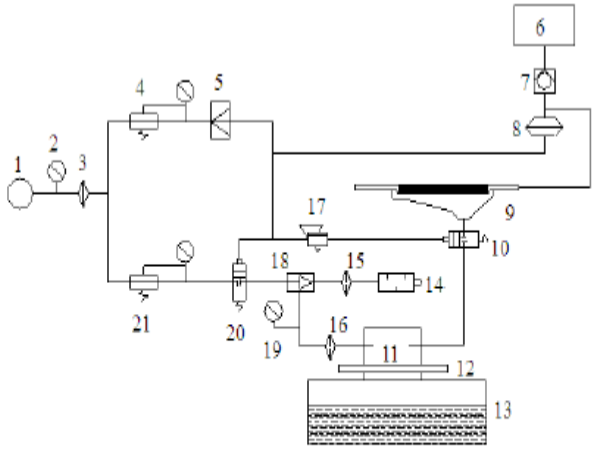
The Wax ring is connected with the cover. It gives support to users. It provides a way to flush Water in Bowl.

F. Seat cover:

The seat cover is the upper part of the toilet pan. It is used to cover the pan after use.

G. Toilet flush:

A simple upgrade of the low flush system by adding a one-liter flush cistern manufactured from polyethylene. [11] The toilet flush is used to clean the toilet pan after use.



1, compressed air reservoir; 2, pressure gauge; 3,14,15,16, filter; 4, 21, reducing valve; 5, control valve; 6, water tank; 7, check valve; 8, supercharger; 9, squatting pan; 10, interface valve; 11, vacuum tank; 12, baffle; 13, fecal sewage collecting box; 14, exhaust muffler; 17, time delay valve; 18, air-jet pump; 19, vacuum gauge; 20, reversing valve;

Fig: 5 Vacuum Toilet System

V. Advantages

Toilet pans available in the market are more comfortable for users.

Save enormous quantities of fresh water, [8] enhance efficiencies of sewer lines and wastewater treatment plants, optimize the cost of plumbing accessories at supply & consumption ends, conserve electricity used for pumping Water & treating wastewater, replace chemical fertilizers with urine to grow crops, produce fertilizer & other chemicals from urine, recover hydrogen for producing energy and fuel, reduce the emission of greenhouse gases and pollution of water bodies. [5]

VI. Disadvantages

The current structure of the toilet pan needs more Water to clean. Material used for toilet pan structure is breakable. Maintenance of the toilet pan is also tough work.

VII. Future of toilet

In the future toilet may be Water less .waste obtained may be utilized for manure.

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