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RESEARCH ARTICLE

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USE OF WASTE GRIT FROM SEWAGE TREATMENT PLANT AS A CONSTRUCTION MATERIAL AND ORGANIC FERTILIZER

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ABSTRACT

Grit and screenings are waste solids that must be disposed of at wastewater treatment plants along with skimming and other solids. Fortunately, their volume is very small so disposal is not as complicated as that for other solids collected in the treatment processes. Grit is removed at almost all sewage treatment plants even though wastewater collection system should be separated so theoretically street washings will not be a part of the waste to be treated. Grit consists of sand, gravel, cinders, or other heavy solid materials that have subsiding velocities or specific gravities substantially greater than that of organic solids in wastewater. The major problems associated with grit include the premature attrition of pumps and mechanical equipment at treatment plants through abrasion and the reduction in conveyance and treatment capacity, and efficiency of processes and systems (e.g. aeration basins).There are operational issues such as blockages also resulting from grit deposition. Generally this grit is disposed at the river banks or on dumping ground. This causes the land pollution and also sometimes water pollution during the rainy season. Hence in this our project the main aim is that can we use this grit for construction? Thus we are going to conduct various experiments on grit to reach our aim

1. INTRODUCTION

Wastewater contains number of pathogenic, micro-organisms and nutrients which can affect the human and the environment. The source of wastewater is from domestic and industrial activities. Both organic and inorganic can occur in the composition of industrial wastewater. On other the hand, mines and metal industries (such as salts of metals and acid) are added the inorganic matter. Screening is the first process used at wastewater treatment plants (WWTP) and helps filter out objects (e.g., solid waste) which may damage and/or clog downstream equipment. Grit removal, on the other hand, involves the removal of sand, gravel or other heavy solid materials, usually those thathave higher specific gravity than the organic biodegradable solids in the wastewater.

In primary treatment grit is most important material which comes out of the grit chambers. Generally this grit is disposed at the river banks or on dumping ground. This causes the land pollution and also sometimes water pollution during the rainy season. Thus we are going to conduct various experiments on grit to reach our aim.

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1.1 Objectives of work:

- To check out the various properties of grit which are required for construction as a material.
- To analyze the strength parameter by testing for construction.
- To determine the suitability of grit for agricultural point of view.

2. LITERATURE REVIEW

2.1 ARTICLE NO. I:

Title: Fundamentals of Grit Removal andGrit System Evaluation –Part 1 (February 27, 2013) by "Water Environment Federation ''

Contents:

1. What is Grit?

What is not Grit?

Why We Should Care?

2. Where Does Grit Come From?

3. Grit is a Common and Serious Problem for Many Wastewater Treatment Plants Understanding What Grit is and is Not Can be Critical.

• Grit is often assumed to behave (settle) like clean sand in clean water.

4. Collection System Basics

5. Average Median Size Distribution of Grit

6. Distribution of Grit at WWTPs

7. Grit Is Not Clean Sand

Assumptions	Reality
All silica sand	Variety of materials
2.65 specific gravity	Variety of specific gravity
Perfect spheres	Variety of shapes
Perfectly quiescent basin	Basins not quiescent
Clean sand in clean water	Fats, oils, greases, soap, scum in collection system

Table no.1 – Grit Information

8.Unit Processes of Grit Separation

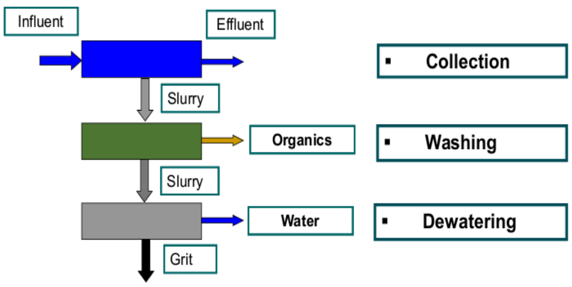

Fig.no.1 – Grit Removal

9.Grit Accumulates at Every Opportunity

10.Critical Considerations

ARTICLE NO.II

Title: Technology: Screening and Grit Removal

By Wastewater Innovation: Making Sanitation A Sustainable Business

Contents:

1.Description:

Screening is the first process used at wastewater treatment plants (WWTP) and helps filter out objects (e.g., solid waste) which may damage and/or clog downstream equipment.

2.Applicability

Owing to the large range of screening and grit removaldevices currentlyavailable, proper design must be conductedto select the most appropriate option, responsive to a particular situation.

3.Performance

Various literatures would attest to the effectiveness of theuse of screen and grit removal systems. In general, the performance of bar screens is largely dependent on the bar spacing implemented.

4.Advantages and Disadvantages

A] Screening-

Manual

Mechanical

B]Communitors and Grinders-

C] Grit Removal

Aerated Grit Chamber

Vortex-type Grit Chamber

Detritus Tank

Horizontal Flow Grit Chamber

5.Cost

The cost of screens and grit removal systems varies depending on the type of technology used, ancillary equipment, and applicability of various technologies to different situations.

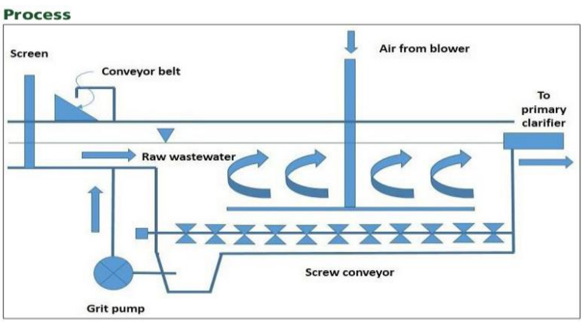

Fig no.2 – Grit removal process

ARTICLE NO.III

Title: Concrete Block Paving:

A walk-over in cost, looks and durability for Concrete Block Paving

Book 1: Introduction Published by the Concrete Manufacturers Association

Contents:

1. Introduction:

Segmented concrete paving is a system of individual shaped blocks arranged to form a continuous hard-wearing surface overlay.

2. Applications of concrete block paving:

i) Roads

Main roads, Residential roads, Urban renewal, Intersections, Toll plazas, Pedestrian crossings, Taxi ranks, Steep slopes, Pavements (sidewalks).

ii} Commercial Projects

Car parks, Shopping centers and malls, Parks and recreation centers, Golf courses and country clubs, Zoos, Office parks, Service stations, Bus termini, Indoor areas.

iii} Industrial Areas

Factories and warehouses, Container depots, Military applications, Mines, Waste water reduction works, Quarries, Airports and harbors.

iv) Domestic Paving

Pool surrounds, Driveways, Patios, Townhouses and cluster homes.

v) Specialized Applications

Cladding vertical surfaces, Storm water channels, Embankment protection under freeways, Roof decks.

Fig. no.3Use of paver blocks

3. Labor Based Construction:

4. Patterns in concrete block paving:

5. Comparisons of concrete block paving with other block paving:

6.Future of concrete block paving:

The market for paving blocks is, at present, a growing one. One of the main reasons for the growth of this very specialized market would seem to be the worldwide tendency for beautification of cities, parks and gardens.

ARTICLE NO.IV

Title: Current Status of the Fertilizer Industry in India – PolicyEnvironment and Implications for the future

By U.S. Awasthi, Managing Director,IFFCO, New Delhi.

Contents:

1.Abstract-

2.Introduction-

3. Draft Long Term Fertilizer Policy-

4. Implications for Future-

4.1 Production of Fertilizers

4.2 Imports of Fertilizers

4.3 Investment in Fertilizer Industry

Fertilizer production is capital intensive and presently the cost ofproduction of indigenous material is high and returns on investment are low.

4.4 Feed Stock Option

4.5 Subsidy on Fertilizers

4.6 Research and Development Efforts

4.7 Distribution Network of Industry

4.8 General Health of the Industry

4.9 Fertilizer Consumption

4.10 Innovative Approaches in Increasing Nutrient Use Efficiency

The low efficiency of fertilizer use in India is a matter of concern. Nitrogen use efficiency in rice crop is only 30-35 percent, with an overall efficiency level at 50 percent.

3.METHODOLOGY

3.1Grit Strength Analysis:

For collection of samples of grit we visited the different Sewage Treatment Plant which are under PUNE MUNICIPAL CORPORATION and PIMPARI-CHINCHWAD MUNICIPAL CORPORATION. For that we take out the permission from authority of both i.e. PMC and PCMC .We visited the following STPS :

STPS under PMC :

1. Kharadi Sewage treatment Plant,Kharadi,Pune.
2. Mundhawa Sewage treatment Plant,Mundhawa,Pune.

3. BhairobaNala Sewage Treatment Plant, KoregaonPark,Pune.
4. Dr.C.K.Nayadu Sewage Treatment Plant,Pune.

STPS under PCMC :

1. Akurdi Sewage treatment Plant,Akurdi,Pune.
2. Dapodi Sewage treatment Plant,Dapodi,Pune.
3. Kasarwadi Phase –II Sewage Treatment Plant,Kasarwadi ,Pimpari,Pune.
4. Kasarwadi Phase –III Sewage Treatment Plant,Kasarwadi ,Pimpari,Pune.

3.2 Experiments:

On the grit samples we conducted the various experiments to check the feasibility of different contents present in it .The experiments which are taken are as follows:

1. Moisture Content Test-

Result:

It is seen that ,all the grit samples contain more than 50% of moisture.

Conclusion:

From the above results, it is conclude that the grit contains moisture which is to be considering in the design of concrete.

Fig.No.4 – Moisture content Test

2.Organic and Inorganic Matter Test-

Conclusion:

We selected two plants out of 8 plants for the further analysis ;i.e specimen B (Mundhawa) & specimen H (Kasarwadi)

B (Mundhawa) & specimen H (Kasarwadi Ph. III) with inorganic matter content 40.10 & 42.35 respectively.

Fig.No.5 –Organic Matter Content Test

Table no.2 – OM & IOM Results

Observation Table :

Specimen number	A	B	C	D	E	F	G	H
Porcelain dish number	1	2	3	4	5	6	7	8
MP = Mass of empty, clean porcelain dish (grams)	15.02	15.32	32.02	15.31	15.02	32.02	15.32	32.02
MPDS = Mass of dish and dry soil	17.34	20.98	40.10	17.87	16.43	34.52	18.97	35.94

(grams)								
MPA = Mass of the dish and ash (Burned soil) (grams)	15.33	19.01	38.14	15.80	15.26	32.54	16.40	33.68
MD = Mass of the dry soil (grams)	2.32	5.66	8.07	2.56	1.41	2.50	3.65	3.92
MA = Mass of the ash (Burned soil) (grams)	0.31	2.27	2.71	0.49	0.24	0.52	1.08	1.66
MO = Mass of organic matter (grams)	2.01	3.39	5.36	2.07	1.17	1.98	2.57	2.26
OM = Organic matter, %	86.63	59.90	66.42	80.85	82.97	79.20	70.41	57.65
IOM= Inorganic matter %	13.37	40.10	33.58	19.15	17.03	20.80	29.59	42.35

Overall Conclusions:

1. From the above two experiments i.e. Moisture Content and Organic and inorganic matter content, we find that MUNDHAWA Sewage Treatment plant and KASARWADI PH.III Sewage Treatment Plant contains inorganic matter more than other STPS.

2. So we select these two plants for further study of our project i.e.

i) To find out the strength in concrete of grit.

ii) To analyze the use of grit in making of paver block.

For further study we take the samples of **Mundhawa** and **KasarwadiPh.III STP**. In our next study we take out the following experiments on grit:

1. Specific Gravity of materials
2. Sieve Analysis of grit
3. Silt Content
4. Water Absorption

1. Specific Gravity of materials

Results:

1.Specific gravity of fine aggregate is 2.62.

2. Specific gravity of coarse aggregate is 2.65.

3. Specific gravity of washed grit (Mundhawa) is 1.98.

4. Specific gravity of washed grit (Kasarwadi) is 2.28.

5. Specific gravity of grit sample (Mundhawa) is 1.55.

6. Specific gravity of grit sample (Kasarwadi) is 1.68.

2. Water Absorption Test:

SR. NO.	SAMPLE	WEIGHT OF SATURATED SURFACE DRY SAMPLE (W_1)	WEIGHT OF ONE DRIED SAMPLE (W_2)	WEIGHT OF WATER ABSORBED (W_1–W_2)	PERCENTAGE OF WATER ABSORPTION $\frac{(W_1-W_2)}{W_2}$
1	Fine Aggregate	405.6	400	5.6	1.4%
2	Coarse Aggregate	402.8	400	2.8	0.7%
3	Wash Grit in (mundhwa)	306.3	300	6.3	2.1%
4	Wash grit in (kasarwadi)	304.8	300	4.8	1.6%
5	Grit in mundhawa)	349.31	319	30.31	9.5%
6	Grit in (Kasarwadi)	350.21	321	29.21	9.1%

Conclusion: Grit contains more water than any other materials.

3.3 DETAILS OF CONCRETE MIX DESIGN

3.3.1 Plain Concrete

Water	Cement	F A	C A
181.37	383.16	742.07	1112.14
	1	1.9	2.9

Amount of Materials Required For one (15cm ✕15cm ✕ 15cm) cube

	Materials	Quantity
1.	Cement	1.29 kg/cm^3
2.	Fine aggregate	2.5 kg/cm^3
3.	Coarse aggregate	3.75 kg/cm^3
4.	Water	0.62 kg/cm^3

3.3.2 Wash Grit Mix Design :

Mundhawa STP :

Mix proportion

Water	Cement	F A	C A
191.58	383.16	542.52	1100.04
0.5	1	1.42	2.87

KasarwadiPh.III STP:

Mix proportion

Water	**Cement**	**F A**	**C A**
191.58	**383.16**	**624.72**	**1100.04**
0.5	**1**	**1.63**	**2.87**

3.3.3 Grit Mix Design:

Mundhawa STP:

X. Mix proportion

Water	Cement	F A	C A
191.58	383.16	424.7	1100.04
0.5	1	1.11	2.87

KasarwadiPh.IIISTP :

Water	Cement	F A	C A
201.42	383.16	446.14	1104.44
	1	1.06	2.88


Fig No. 5 – Casting of cubes

3.4 TESTING OF CUBES :

When the casting is carried out at that time fresh concrete test was conducted and after that compressive test is taken.

Results:

Sr.No.	Particulars	7 Days		Avg.	28 Days		Avg.
		Load Failure (KN)	Comp. Strength (N/MM^2)		Load Failure (KN)	Comp. Strength (N/MM^2)	
1	PLAIN CONCRETE	538	23.91	23.37	626.7	27.85	27.70
		514	22.84		620.1	27.56	
2	MUNDHAWA						

	WASHED GRIT	409.63	18.20	18.38	487.27	21.65	21.88
		417.76	18.56		497.53	22.11	
	WITHOUT WASHED GRIT	210.68	9.36	9.07	260.58	11.58	10.89
		197.93	8.79		229.33	10.19	
3	**KASARWADI**						
	WASHED GRIT	435.38	19.34	19.11	517.36	22.99	23.25
		425.24	18.89		529.15	23.51	
	WITHOUT WASHED GRIT	243.18	10.80	10.89	270.13	12.05	11.84
		247.22	10.98		261.87	11.63	

3.4 PAVER BLOCK ANALYSIS

3.4.1 Introduction

Interlocking Concrete Paver Block (ICPB) has been extensively used in a number of countries for quite some time as a specialized problem-solving technique for providing pavement in areas where conventional types of construction are less durable due to many operational and environmental constraints. Paver block is solid, unreinforced pre-cast cement concrete paving units used in the surface course of pavement

3.4.2 Testing of Paver block

For 50 mm paver tiles:-

SR.NO	TEST	SPECIFICATION Average Values
1	28 day Compressive strength	Minimum 37.1 MPa (N/Sq.mm) (restricted to 31.5 MPa in individual test units)
2	Water Absorption	Avg. of 3 units - Maximum 6% by mass (restricted to 7% in individual test units)

Fig.No.6 – Paver Block Making

3.4.3 Compressive Strength Test

Sr.No.	**Particular**	**7 Days**		**28 Days**	
		Load Failure (KN)	**Comp. Strength (N/MM^2)**	**Load Failure (KN)**	**Comp. Strength (N/MM^2)**
1	**PLAIN CONCRETE**	1628.10	34.64	1942.51	41.33
2	**MUNDHAWA**				
	WASHED GRIT	1470	30.85	1618.68	34.43

	WITHOUT WASHED GRIT	815.08	17.34	943.29	20.07
3	**KASARWADI**				
	WASHED GRIT	1580.54	33.62	1780.83	37.89
	WITHOUT WASHED GRIT	919.6	19.56	1037.29	22.07

3.5 FERTILIZER ANALYSIS

3.5..1 Introduction

India became self sufficient in food grain production after the first GreenRevolution in the 1960s establishing itself as one of the leading food producers in the world. Various factors contributed to its success storyincluding high yielding variety seeds, increased irrigation facilities andhigher application of inputs like fertilizers.

3.5.2 Need of organic fertilizer

Environmental degradation is a major threat confronting the world, and the rampant use of chemicalfertilizers contributes largely to the deterioration of the environment through depletion of fossil fuels,generation of carbon dioxide (CO_2) and contamination of water resources. It leads to loss of soilfertility due to imbalanced use of fertilizers that has adversely impacted agricultural productivity andcauses soil degradation.

1. Organic Fertilizers:

It is home - made fertilizers. The use of this fertilizer does not affectthe structure of land. This fertilizers needs in excess quantity and it takes five to mix with land. This fertilizer induces all types of organic elements which hold the fertility of the land for longer period of time. This fertilizer also called the complete fertilizer. This fertilizer includes cow dung, manure of human being urine, manure of various types of cake, fish manure bone, mill manure and bio-fertilizer.

4. CONCLUSION

The analysis shows that

- By conducting various experiments we have concluded that Mundhawa and Kasarwadi PH-3 plants sample containing more sand particles than that of other plants.
- Construction material - The grit collected can be used for various on-site activities like Plain Cement Concrete (PCC) works, mortar, sub-grade, etc.
- Organic Soil Composts leading to higher productivity of crop.

5. ACKNOWLWDGEMENT

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6. REFERENCES

[1]. Waste Water Technology Fact Sheet (screening and grit removal)-United States Environmental Protection Agency.

[2]. Grit Characterization in Florida Wastewater Plant-Moss-Kelly Inc.

[3]. GritHappens-You Don't Know What You Are Missing(Pat Herrick, Hydro International Wastewater Division)

[4]. IS383-1970 Specification for coarse and fine aggregate from natural sources for concrete

[5]. M.S Shetty,1987,S.Chand ,Concrete Technology

[6]. IS2386-1963 Methods of test for aggregate for concrete