

DESIGN OF FILTRATION SYSTEM FOR OKAMOTO GRINDING MACHINE

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Abstract: OKAMOTO Universal grinding machine is used for grinding the Silicon-carbide (SiC) which is used for making parts of seal. Components made of Silicon carbide(sic) produces very fine burr of Sic material (as its brittle, nearly in powder form) which mixed in the coolant (Lube grind 2000CG) during the process this affects the coolant quantity and reduces coolant replacement cycle time (7 Days). Filtration of nearly dissolved solid from the solution is somehow difficult and cannot be achieved conventional, simple filtration method e.g. filter paper, magnetic filter etc. Hence it requires step by step approach. The existing filtration method is inefficient and had bad effects on coolant quality and its life. Our aim is to implement new method to separate out fine particles of Sic from coolant and reuse the coolant. Filtration process is divided in three stages (primary, secondary, tertiary) in primary stages sedimentation is carried out using advantage of mass density of fine sic particles. Secondary stage includes sand bed filtration of sediment coolant and further in tertiary stage press filter/PE filter is used to remove very fine particle (below 5 micron) from the coolant. As per our requirement we design sedimentation tank and their respective components as well as manufactured those components. By using above three stages of filtration process will give improved performance of coolant in terms of quality and increased coolant replacement time.

Keywords - OKAMOTO Grinding Machine, SiC Material(<5micron), Synthetic Coolant, Cycle time, Sedimentation, Sand filter ,Sludge

I. INTRODUCTION

EagleBurgmann India Pvt. Ltd. is the market leader in the mechanical seal industry in India, with over 40 years of rich experience. With its headquarters and main manufacturing location situated in Pune, it also has two other manufacturing locations in Mumbai and Vapi. At EagleBurgmann, we have always catered to challenging applications in the industry and hence are known more popularly as a "sealing solutions provider" rather than merely a seal manufacturer. But at the Grinding section there is Okamoto Grinding machine and workers facing the problem of less reliable coolant means the life of coolant is very less (Seven days only). OKAMOTO Universal grinding machine is used for grinding the Silicon-carbide material (SiC) which is used for making parts of seal. But the burr(in powdered form as it is brittle) produced during the operation of SiC material is getting mixed with the coolant. The coolant used for this is Synthetic Coolant. Synthetic coolant is mixing with the SiC burr in such a way that it becomes very difficult to separate out the suspended SiC material from the coolant by any conventional filtration technique. The machine is already provided with its own filtration setup including the filter paper which not gives satisfying required results. All the above problems tend to the poor life of the coolant. The coolant is only applicable to use for maximum 7 days. To change the coolant for every 7 days and to run the machine on such poor filtration process is not economical for company.

II. LITERATURE REVIEW

- [1] B. Kholisa et.al. = Making water reusable by separating sludge (waste) from water. This is done in 3 stages (Primary, secondary, tertiary). This method separates cake solids suspended solids, and solid capture from waste water. Belt press filter is important component used in third stage.
- [2] Doohyn Kim et. al. = The conventional methods to improve heat transfer rate include passive techniques with application of extended rough surfaces and swirl flow and active techniques with surface or fluid vibration and mechanical aids. The enhancement of convective heat transfer is described with two stable Nano fluids ALUMINA (Al₂O₃) and amorphous carbonic nanoparticles laden fluids.
- [3] Peter Schuten ey. al. = Chamber filter is one of the effective method for separating water from sludge or dewatering the sludge. Which compresses the sludge between the frames and allow water to go forward, forming the sludge cake between the frames. AODD pump is used for applying pressure to sludge.
- [4] OKAMOTO surface grinding machine manual PSG/ACC DX Series is Japanese manufactured grinding machine use for internal as well as external surface grinding. It simplifies down feed operation with high precision as Rough grinding and Fine grinding.
- [5] Material Safety Data Sheet LUBGRIND 2000CG = It is basically helpful for better handling of coolant and describe coolant behavior at different temperatures, its effect on surrounding on heating, acidity/alkalinity and safety measures to avoid its bad effect on environment as well as for worker safety.

[6] Juliana Dotto, Rosangela Bergamasco.(2018) = Performance of different coagulants in the coagulation/flocculation process of textile waste water. A comparative study of the efficiency of different coagulants in the textile wastewater treatment was carried out. The utilization of natural coagulants instead of the synthetic ones has demonstrated significant advantages since it provides a low cost and environmentally friendly technology for removing dyes.

[7] Abdullah Almojjly, Daniel Johnson, Stephen Mandale, Nidal = Optimization of the removal of oil in water emulsion by using ceramic microfiltration membrane & Hybrid coagulation/sand filter. One method to remove oil droplets from wastewater is using ceramic tubular microfiltration membranes.

DESIGN

I. PROBLEM SPECIFICATION

- OKAMOTO Universal grinding machine is used for grinding the Silicon-carbide (SiC) material which is used for making parts of seal. But the burr (in powdered form as it is brittle) produced during the operation of SiC material is getting mixed with the coolant. The coolant used for this is Synthetic Coolant. Synthetic coolant is mixing with the SiC burr in such a way that it becomes very difficult to separate out the suspended SiC material from the coolant by any conventional filtration technique.
- The machine is already provided with its own filtration setup including the Filter paper which not gives satisfying the required results.
- All the above problems tend to the poor life of the coolant. Due to the coolant loses its properties within 7 days, the coolant is only applicable to use for maximum 7 days. To change the coolant and to run the machine on such poor filtration process is not economical for the company.

II. DIFFERENT DESIGN OF SEDIMENTATION TANK

1. Rectangular tank

- Length : 2m
- Breadth : 1m
- Height : 0.75m
- Volume = Length X Width X Height
- $V = l * w * h = 2 * 1 * 0.75 = 1.5 \text{ m}^3 = 1500 \text{ litre.}$

2. Circular tank

- Diameter : 1m
- Height : 2m
- Taper Height : 0.5m
- Taper Major Diameter : 1m
- Taper Minor Diameter : 0.8m
- $V = \pi * r^2 * h = 1570 \text{ litres}$

3. Sludge tank

- Length : 0.65m
- Width : 0.6m
- Height : 0.5m
- $V = l * b * h = 0.195 \text{ m}^3$

III. DIFFERENT DESIGNS OF SAND FILTER

Type-rapid sand filter

- Design of rapid sand filter to treat $Q=1500 \text{ lit/day}$
- Allowing the filter water for backwashing. $Q_w=3 \text{ to } 5\%$
- Total number of filter =4
- Length per width of filter=1:2 m
- Length of Sand filter= $70 * 10^{-2} \text{ m}$
- Width of sand filter= $170 * 10^{-2} \text{ m}$

Backwash through Design

- Number of backwash troughs=2
- Discharge of each trough= $Q/4=750 \text{ lit/day}$
- Diameter of inlet pipe coming through filter= $1^{1/2} \text{ ``}$
- Backwashing time = 2.15
- Backwash pressure= $P1-P4=10 \text{ psi} = 0.85 \text{ kg/cm}^2$
- Total washing time=1:30 min

III. MODELLING OF TANK

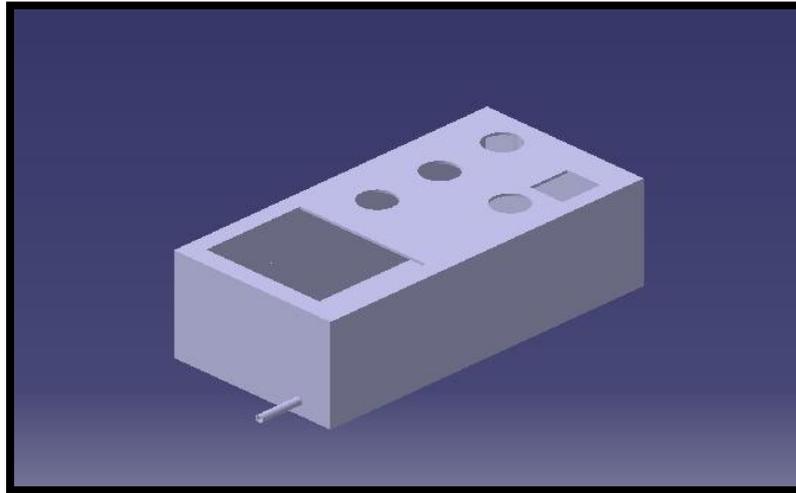


Fig4.1. Rectangular tank

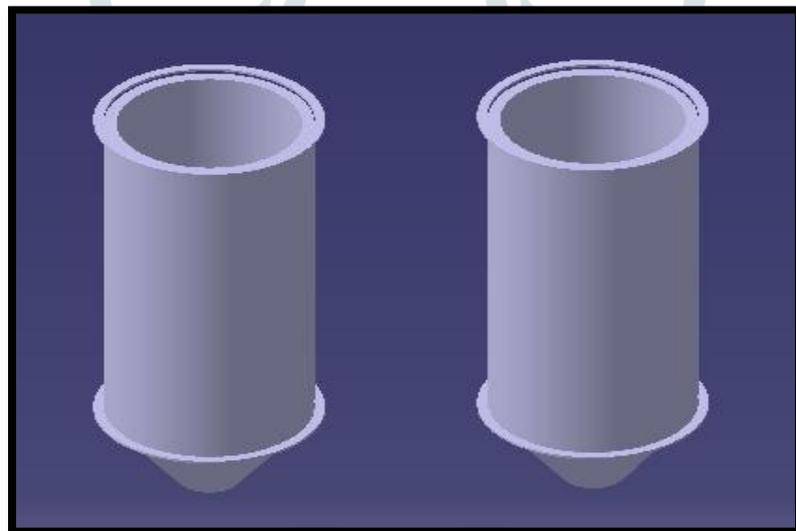


Fig4.2. Circular Tank

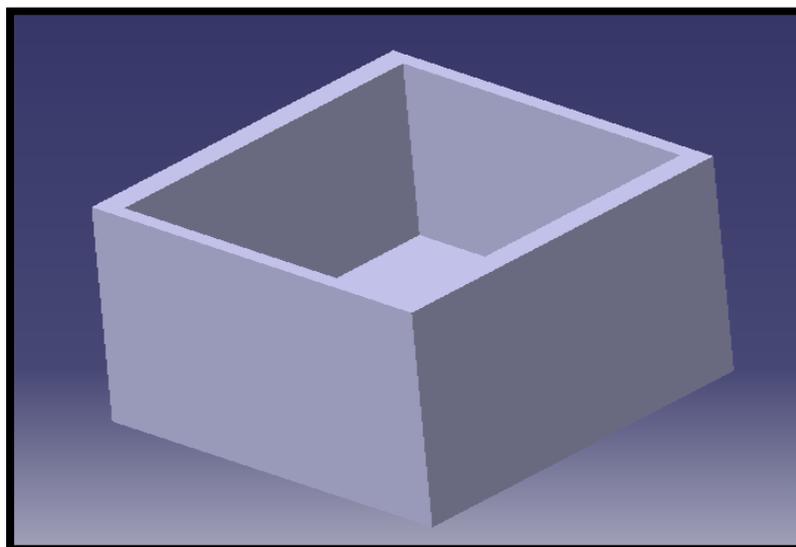


Fig4.3. Sludge Tank

IV. METHODOLOGY

Collection of the coolant from all machines into same tank. As Dirty coolant (Sic burr along with coolant) is returned from the machine tools to the filter system via pump stations located at each tool is collected in a tank. Collect the coolant and sent to vertical cylindrical container & kept it for 24 hrs. for carrying sedimentation of SIC particles. (due to high specific gravity and density) In this of Sic material, Sic material gets situated at bottom of tank and due to light weight and density the coolant gets at top and again collected in another tank. In sedimentation the coolant is not in pure form it also contains some contaminant in coolant. After sedimentation process the coolant is again filtered through the sand bed & filtered coolant is collected in separate tank again ready to use. When coolant is passed through the sand bed, during this process the contaminant gets stick to the sand and fresh coolant is gets stored in another tank.

1. Sedimentation

Sedimentation is the tendency for particles in suspension to settle out of the fluid in which they are entrained and come to rest against a barrier. This is due to their motion through the fluid in response to the forces acting on them: these forces can be due to gravity, centrifugal acceleration, or electromagnetism.

2. Sand Filter

Sand bed filters work by providing the particulate solids with many opportunities to be captured on the surface of a sand grain. As fluid flows through the porous sand along a tortuous route, the particulates come close to sand grains. Sand filters slow the amount of storm water entering the drainage system as well as removing some contaminants. They are usually installed where storm water runoff may collect high levels of contaminants, such as from roads, carparks and industrial areas.

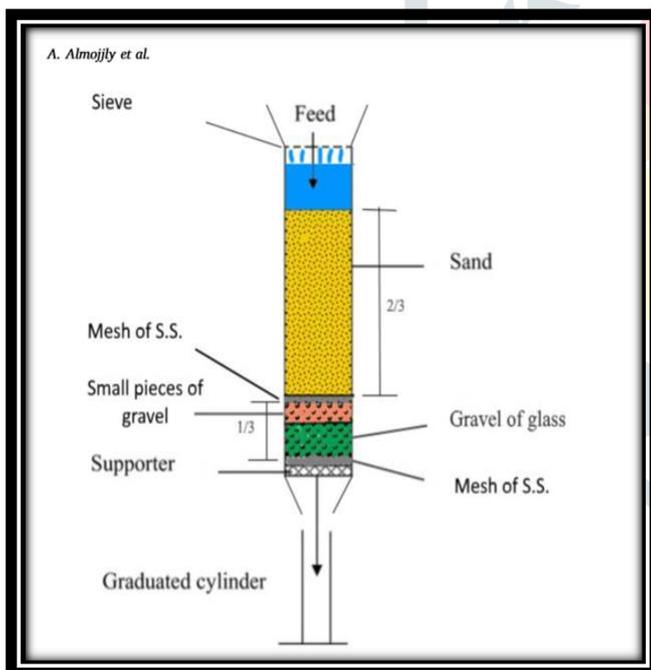


Fig5.1.(a) Sand Filter Concept

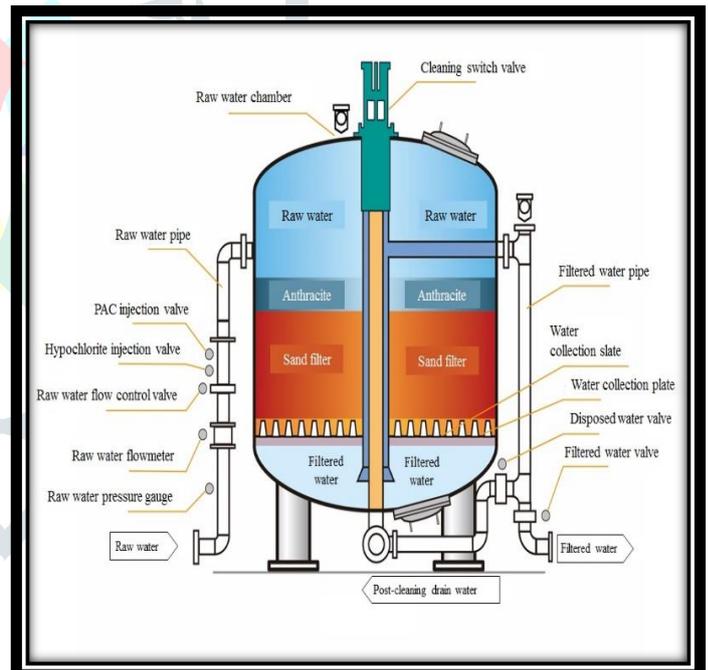


Fig5.1.(b) Sand filter Process

V. RESULT & DISCUSSION

In stage 1 of sedimentation we collected used coolant and kept it in sedimentation tank for 24hrs. During sedimentation Sic particles gets settled down at bottom of sedimentation tank. These happened due to density difference & the gravity force on those heavier Sic particles. About 70% of heavier particle (size > 5micron) get separated in these process. In second stage the sedimented coolant is allowed to pass through sand filter where the particles <5 um are trapped in layers of sand filter and fresh coolant is collected separate tank and further the sand filter is backwashed. PE filter can also be used for filtering the coolant less than 3um.

Table No. 6.1- Result Table

STAGES	PARTICLE SIZE
Before Sedimentation	Above 5 micron
After Sedimentation	Less than 5 micron
After sand bed Filter	<< less than 5 micron

VI. CONCLUSION

By this we have conducted that sic particles can be filtered less than 5 micron by using sedimentation, sand filter, P.E. filter. After sedimentation coolant gets filtered up to 5 micron and after sand filtration process coolant gets filter less than 5 micron. After all stages our coolant replacement cycle time increases and also it improves overall efficiency of Grinding machine. It also increases surface finishing of product.

VII. ACKNOWLEDGEMENT

It's my great pleasure to present this research paper entitled "DESIGN OF FILTRATION SYSTEM FOR OKAMOTO GRINDING MACHINE". I find no words to express my gratitude to our Industrial Guide MR. APOORV DONGAONAR and our College Guide PROF. M.A. KHOT who not only advised and guided us during the earlier stages but also answered all my queries concerning collection of data, proper structuring of the report, and its improvement. I am virtually indebted to the Production Department Head MR. INDER SING from EAGLEBURGMANN who have bestowed all their blessings in the form of guidance which was the leading light to complete this research paper.

VIII. REFERENCE

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