

## Failure Mode and Cost Effect Analysis of a Model Bone Crushing Hammer

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### Abstract:

Critical investigation of strength properties of materials is required in Engineering practice to ensure an enhanced service life. Globally, industrialists are struggling to increase cost savings from lost production due to the failure of machine, while customers are concerned about the safety and reliability of the products. Hammer mills are prone to various modes of failure like chemical failure, erosive failure, abrasive failure and fatigue failure. The effect of these failure modes is always detrimental to the operation of the machine and its efficiency. Hence, forensic investigation is essential to determine the failure modes and their effects on hammer mills for bone crushing. Field investigation was carried out to monitor the hammer mill in operation for 12 months with a production of 20 bags per hour. The total production per day for 8 hours is expected to be 160 bags at a given speed. Thus, the cost of machine downtime on production is huge. The Pareto method was used to determine the effect of downtime on revenue and production for a period of one year. The hours of failure were between 1 to 2 hours per day. The loss in revenue was calculated using the variation of number of failure with time, as obtained from hammer mill. The outcome showed that hammers investigated failed as a result of abrasive wear, fatigue, impact, and chemical wear, respectively. The cost of downtime was found to be \$ 37,745,809,920.00 CAD for the period of study. Based on findings, wide ranging factors are required to evaluate the performance of the hammer mill for improved productivity and efficiency. These are proper material selection, design and appropriate operational parameters. However, there is need for optimisation of the hammer material via heat

treatment methods as this will reduce the yearly cost of production, downtime of the milling machine for bone crushing as well as improvement in productivity.

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