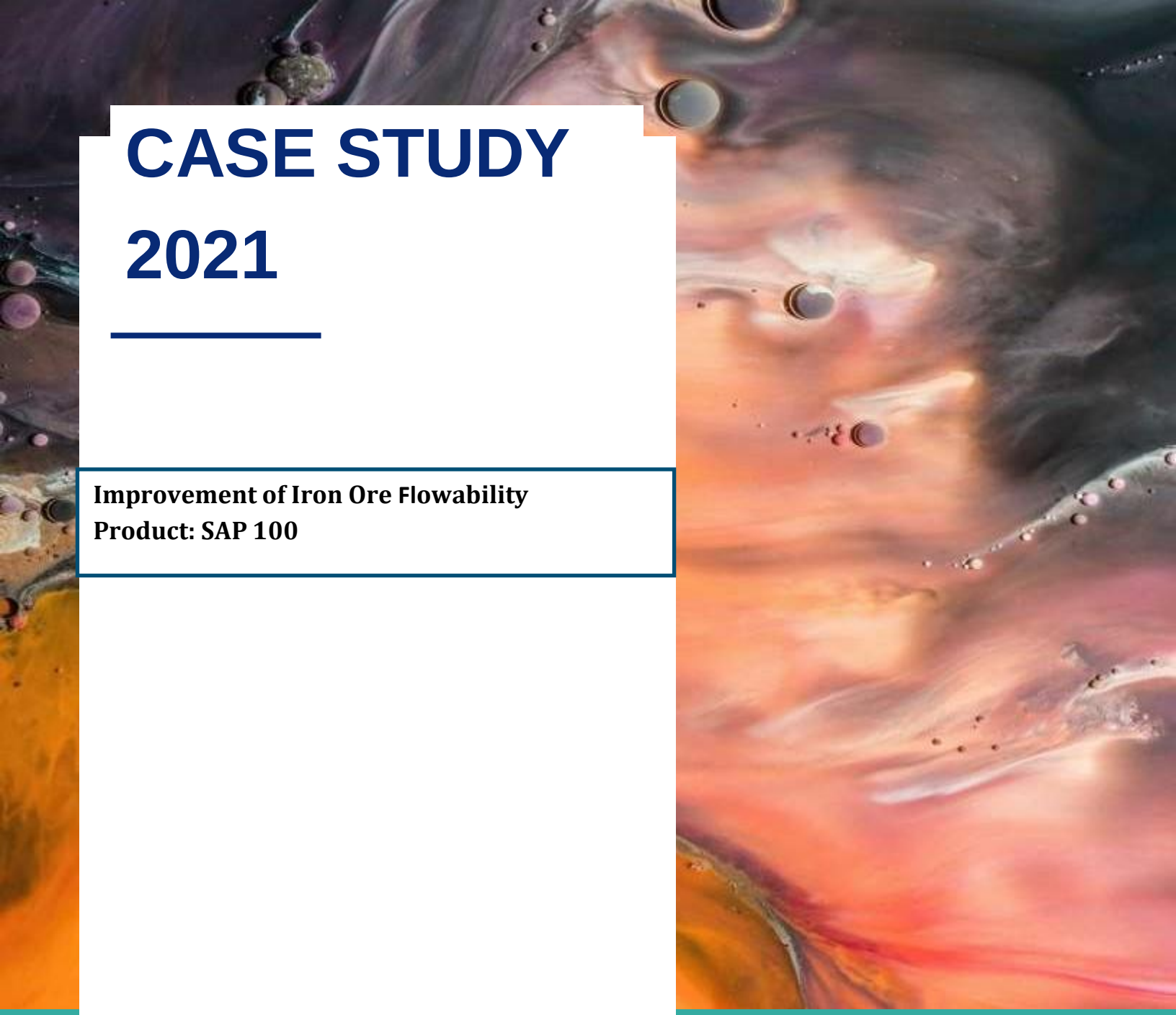

CASE STUDY 2021

Improvement of Iron Ore Flowability
Product: SAP 100

OCTOBER 31

GCHEMICS
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GCHEMICS
Chemistry For A Sustainable Future

DMAIC APPROACH:

DMAIC is the lean six sigma approach which refers to a data-driven improvement cycle used for improving, optimizing, and stabilizing processes and designs.

Define:

Background & Scope Of the Project

Measure:

Base Line Data Before Trial

Analysis: Theory and reference data

Improve: Industrial Trial & Results

Control:

Future Action Plan

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1: Background:

Numerous mineral processing industries particularly dry processing plants handle huge tons of bulk solids such as iron ore in process equipment, conveyors, storage, and transportation. During monsoons, run-of-mine (ROM) ore get exposed to high levels of moisture flowing in bins, silos, and chutes which are eventually plagued with flow problems. The moisture in the ore fines induces cohesion due to the growth of adhering layer around the particles that cause bridge or arch formation in the equipment. Nevertheless, these fines also tended to gain cohesive strength over time and upon stresses thereby consolidation occurs during processing. Consequently, dry processing plants have been suffering from the inconsistent and unpredictable flow that could lead to bridging, channeling, and flooding and resulted in a great disparity of flow. Each of these has negatively impacted production efficiency, operating hours, specification product quality due to segregation and cost. Besides, loading, unloading, and transportation of these moist ores were quite challenging.

Typically, mechanical flow aids such as air blasting, aeration, vibration methods were employed to counter-act consolidation forces, generate forces to disperse loose agglomerates, and break bridging that had taken place. However, these techniques should be used to resolve flow issues once they have occurred and ineffective when the strength of solids is greater than the force generated by these techniques. These techniques including thermal drying required large force fields or heat, or other energy sources to enhance the flow properties. Along with several constraints such as inaccessibility, physical damage, design change, and deterioration or destruction of product, safety hazards also exist for the practical application of these techniques in the plant. Consequently, controlling the surface moisture was the trigger to improve the flowability of ore fines. Although low moisture levels can be attainable, these are limited to ≥10% by any centrifugal or mechanical means regardless of the pressure applied, and these levels increase as the proportion of fines in the feed increases. This was the result of energy utilization in compression rather than destroying liquid bridges between the particles.

Discussion:

Based on the inherent properties, cost, and ability to improve iron ore flowability, SAP 100 was selected for plant trials. During the trial period, plant throughput data and the corresponding SAP 100 dosage were collected. From the FIG, it is clear that TPH per shift of production has increased to N700 tph. Low TPH points were due to other issues such as unavailability of ROM ore, mechanical maintenance, etc. encountered during the plant trials. An average of 40% increase in production rate (TPH) was found at the iron ore dry processing plant.