ANALISIS PENGENDALIAN KUALITAS PADA PRODUK PLS UNTUK MENURUNKAN JUMLAH PRODUK CACAT DENGAN METODE SIX SIGMA

(STUDI KASUS : PT QMB NEW ENERGY MATERIALS)

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Abstrak

Pregnant Leach Solution (PLS) merupakan produk hasil proses High Pressure Acid Leaching (HPAL) yang mengandung nikel terlarut, namun juga berpotensi mengandung kadar besi (Fe) berlebih yang dapat mengganggu proses pemurnian nikel. Penelitian ini bertujuan untuk mengidentifikasi penyebab cacat pada PLS, menghitung level sigma perusahaan, dan memberikan usulan perbaikan kualitas menggunakan pendekatan Six Sigma dan Failure Mode and Effect Analysis (FMEA). Penelitian dilakukan di PT QMB dengan menggunakan 11 sampel PLS, di mana 72% di antaranya memiliki kadar Fe melebihi standar perusahaan (<40%). Tahapan Six Sigma yang digunakan meliputi Define, Measure, Analyze, dan Improve. Hasil pengolahan data menunjukkan nilai rata-rata DPMO sebesar 389.691 dan level sigma sebesar 1,78, yang mencerminkan rendahnya kapabilitas proses. Analisis menggunakan diagram Pareto dan fishbone mengidentifikasi faktor manusia, metode, material, lingkungan, dan mesin sebagai penyebab utama cacat. Berdasarkan perhitungan RPN, faktor kelelahan operator memiliki nilai tertinggi yaitu 384. Rekomendasi perbaikan mencakup pengaturan ulang jam kerja, pengendalian dosis asam sulfat, serta inspeksi rutin pada alat produksi. Diharapkan hasil penelitian ini dapat membantu perusahaan dalam meningkatkan kualitas produk PLS secara berkelanjutan.

Kata kunci: Six Sigma, FMEA, PLS, Kualitas, HPAL, Fe.

QUALITY CONTROL ANALYSIS OF PLS PRODUCTS TO REDUCE THE NUMBER OF DEFECTIVE PRODUCTS USING THE SIX SIGMA METHOD

(CASE STUDY: PT QMB NEW ENERGY MATERIALS)

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Abstract

Pregnant Leach Solution (PLS) is a product of the High Pressure Acid Leaching (HPAL) process that contains dissolved nickel, but also potentially contains excessive levels of iron (Fe) that can interfere with the nickel refining process. This study aims to identify the causes of defects in PLS, calculate the company's sigma level, and provide quality improvement recommendations using the Six Sigma and Failure Mode and Effect Analysis (FMEA) approaches. The study was conducted at PT QMB using 11 PLS samples, of which 72% had Fe levels exceeding the company's standards (<40%). The Six Sigma stages used include Define, Measure, Analyze, and Improve. The results of data processing showed an average DPMO value of 389,691 and a sigma level of 1.78, which reflects low process capability. Analysis using Pareto and fishbone diagrams identified human, method, material, environmental, and machine factors as the main causes of defects. Based on the RPN calculation, operator fatigue had the highest value of 384. Recommendations for improvement include rearranging work hours, controlling sulfuric acid dosage, and routine inspections of production equipment. It is hoped that the results of this study will assist companies in sustainably improving the quality of PLS products.

Keywords*: Six Sigma, FMEA, PLS, Quality, HPAL, Fe.*

DAFTAR PUSTAKA

Alfarizi, N., Noya, S., & Hadi, Y. (2023). Pengendalian Kualitas Menggunakan Metode Six Sigma dan FMEA untuk Mengurangi Reject Material Preform pada Industri AMDK. *Jurnal Sains Dan Aplikasi Keilmuan Teknik Industri (SAKTI)*, *3*(1), 01–12. https://doi.org/10.33479/jtiumc.v3i1.41

Basuki, D. E., Cahyo, W. N., Handayani, D., Apriani, R. A., & Mukarim, R. N. (2023). Combined Waste Assessment Model and Fuzzy-FMEA in Lean Six Sigma for Generating Waste Reduction Strategy: A Proposed Model. *Jurnal Teknik Industri*, *25*(2), 153–168. https://doi.org/10.9744/jti.25.2.153-168

Erlin Riandari, Susetyo, J., & Asih, E. W. (2022). Pengendalian Kualitas Produksi Genteng Menggunakan Penerapan Metode Six Sigma Dan Failure Mode and Effect Analysis (Fmea). *Jurnal Rekavasi*, *10*(1), 64–71. https://doi.org/10.34151/rekavasi.v10i1.3884

Fimahali, A. Y., & Sumiati, S. (2023). Analysis of the Quality of Bottled Drinking Water Products through a Six Sigma Approach and Failure Mode and Effect Analysis (FMEA). *Journal of Applied Science, Engineering, Technology, and Education*, *5*(1), 73–82. https://doi.org/10.35877/454ri.asci1729

Hanifah, P. S. K., & Iftadi, I. (2022). Penerapan Metode Six Sigma dan Failure Mode Effect Analysis untuk Perbaikan Pengendalian Kualitas Produksi Gula. *Jurnal INTECH Teknik Industri …*. https://e-jurnal.lppmunsera.org/index.php/INTECH/article/view/4655

Izza, A., & Retnowati, D. (2021). Analisis Kualitas Produk Furniture Dengan Pendekatan Metode Six Sigma. *Heuristic*, 59–72. https://doi.org/10.30996/heuristic.v18i2.6149

Jasmine, I. A., Salma, S. A., & Susanto, H. (2024). *Jersey Production Quality Control Using Six Sigma and FMEA Methods To Minimize Product Defects*. *10*(2), 413–423.

Jihan Shofa, M., & Gunawan, H. (2017). Implementasi Six Sigma untuk Perbaikan Produk Nickel Pig Iron. *Jurnal Sistem Dan Manajemen Industri*, *1*(1), 29. https://doi.org/10.30656/jsmi.v1i1.171

Kaganova, I. M., Kaganov, M. I., Straten, P. Van Der, Morgenstern, R., Nakamura, N., & Currell, F. J. (2016). *Plastic Injection Quality Controlling Using the Lean Six Sigma and FMEA Method Plastic Injection Quality Controlling Using the Lean Six Sigma and FMEA Method*. https://doi.org/10.1088/1757-899X/105/1/012006

Kholil, M. (2022). Quality Control Analysis of Pillow and Bolster Products with DMAIC And FMEA Method Approach in CV. Saiky Indonesia. *International Journal Of Scientific Advances*, *3*(2), 244–250. https://doi.org/10.51542/ijscia.v3i2.16

Lestaluhu, M. A. M. (2023). *ANALISIS PERBANDINGAN KADAR BIJIH NIKEL LATERIT ANTARA SAMPEL TEST PIT DAN SAMPEL RE-CHECK PIT X PT ANTAM Tbk UBPN KOLAKA*.

Lestari, F. A., & Purwatmini, N. (2021). Pengendalian Kualitas Produk Tekstil

Menggunakan Metoda DMAIC. *Jurnal Ecodemica: Jurnal Ekonomi, Manajemen, Dan Bisnis*, *5*(1), 79–85. https://doi.org/10.31294/jeco.v5i1.9233

Lutfianto, M. A., & Prabowo, R. (2022). Implementation of Six Sigma Methods with Failure Mode and Effect Analysis (FMEA) as a Tool for Quality Improvement of Newspaper Products (Case Study: PT. ABC Manufacturing – Sidoarjo, East Java – Indonesia). *Journal of Integrated System*, *5*(1), 87–98. https://doi.org/10.28932/jis.v5i1.4615

Metode, D., Sigma, S. I. X., Fmea, D. A. N., Pt, D. I., Indonesia, P., Methods, F., Pt, I. N., & Indonesia, P. (2018). *Defect rate*. *7*(1), 162–174.

Montororing, Y. D. R., Widyantoro, M., & Muhazir, A. (2022). Production process improvements to minimize product defects using DMAIC six sigma statistical tool and FMEA at PT KAEF. *Journal of Physics: Conference Series*, *2157*(1). https://doi.org/10.1088/1742-6596/2157/1/012032

Muvidah, N. I., Yunitasari, E. W., & Kusmendar, K. (2023). Pengendalian Kualitas Produk Menggunakan Lean Six Sigma dan Fuzzy FMEA Dalam Upaya Menekan Kecacatan Produk. *Jurnal Engine: Energi, Manufaktur, Dan Material*, *7*(2), 86. https://doi.org/10.30588/jeemm.v7i2.1617

Nugraha, R. F., Sofyan, H., Fawa, A., & Fata, I. (2024). *Pengendalian Kualitas Produk Menggunakan Metode Six-Sigma Dan Failure Mode And Effect Analysis di Perusahaan Core Board Purwakarta Product Quality Control Using Six-Sigma Method and Failure Mode and Effect Analysis at Core Board Purwakarta Company*. *14*(2), 508–517. https://doi.org/10.51132/teknologika.v14/2

Patel, A. S., & Patel, K. M. (2022). *Production process improvements to minimize product defects using DMAIC six sigma statistical tool and FMEA at PT KAEF Production process improvements to minimize product defects using DMAIC six sigma statistical tool and FMEA at PT*. https://doi.org/10.1088/1742-6596/2157/1/012032

Primahesa, I. G., & Ngatilah, Y. (2022). Quality Analysis of Bakery Products Using the Six Sigma Method and Failure Mode and Effect Analysis (Fmea) Case Study on Cv. Xyz. *International Journal on Advanced Technology, Engineering, and Information System (Ijateis)*, *1*(2), 59–72. https://doi.org/10.55047/ijateis.v1i2.319

Pujotomo, D., & Anida, V. (2019). Pengendalian Kualitas Dengan Metode Six Sigma Pada Produk Sepatu Di Cell 1 PT. XYZ. *Dalam Jurnal Seminar Dan Konferensi*.

Purnomo, N. D., Mindhayani, I., Permatasari, I., Studi, P., Industri, T., Mataram, U. W., Author, C., & Mandiri, R. (2023). *Analisis Kualitas Produksi Flends Menggunakan Metode Six Sigma Dan FMEA*. *5*(2), 99–107.

Riadi, M. (2021). *Kualitas Produk (Pengertian, Manfaat, Dimensi, Perspektif dan Tingkatan)*. https://www.kajianpustaka.com/2020/02/kualitas-produk-pengertian-manfaat-dimensi-perspektif-dan-tingkatan.html

Rifaldi, M., & Sudarwati, W. (1846). *Penerapan Metode Six Sigma dan FMEA Sebagai Usaha untuk Menggurangi Cacat pada Produk Bracket*. *April 2024*, 1–9.

Rizki, M., Wiyatno, T. N., & Astuti, R. F. (2024). *Quality Control of Ceramic Wall*

Products Six Sigma Method with Dmaic Tools and Failure Mode and Effect Analysis (FMEA). *9*(6), 1027–1040.

Saryanto, S., Purba, H. H., & Trimarjoko, A. (2020). Improve quality remanufacturing welding and machining process in indonesia using six sigma methods. *Journal Europeen Des Systemes Automatises*, *53*(3), 377–384. https://doi.org/10.18280/jesa.530308

Sitompul, A. A., & Fazri, M. (2023). *Pengendalian Kualitas Curd Palm Oil Menggunakan Integrasi Metode Six Sigma-FMEA di PT Grahadura Leidong Prima*.

Spm, P. P. T. (2020). *Dengan Pendekatan Metode Six Sigma*. *3*, 1–7.