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A Cleaner Production Process of Sodium Dichromate Via Pressure Oxidative Leaching of Chromite

XU H. B. ^{a,b,*}, SHI Y. L. ^c, ZHANG H. L. ^{a,b}, CHENG X. C. ^c, PEI L. L. ^{a,b}, LIU J. W. ^c, QING P. H. ^{a,b}, TIAN Y. ^{a,b}, CAI. Z. H. ^c, ZHANG Y. ^{a,b}

a. National Engineering Laboratory for Hydrometallurgical Cleaner Production Technology, Institute of Process Engineering, Chinese Academy of Sciences, Beijing 100190, China

b. Key Laboratory of Green Process and Engineering, Chinese Academy of Sciences, Beijing 100190, China

c. Hubei Zhenhua Chemical CO., LTD, Huangshi 435001, Hubei, China

**Corresponding author, hbxu@ipe.ac.cn*

Abstract

Chromium compounds are important basic chemicals and find application in various industrial fields. The environmental problems resulted from the traditional production process of sodium dichromate have spawned worldwide public concerns. With a design objective to eliminate pollution at the source, a cleaner production process of sodium dichromate was developed, and the cleaner process has successfully achieved higher resource utilization efficiency and zero emission of the chromium-containing residue.

In the cleaner process, the conversion from chromite ore to sodium dichromate includes four steps: (1) the pressure oxidative leaching of chromite ore with concentrated NaOH solution; (2) the extraction of NaOH with CH₃OH from the solid mixture of chromite ore leaching residues (COPRs) and sodium chromate crystal; (3) the distillation and recovery of CH₃OH from aqueous concentrated NaOH solution; and (4) the manufacturing of sodium dichromate from the COPR containing sodium chromate crystal.

It was found that, under the optimal conditions, the chemical conversion ratio of trivalent chromium in chromite through Step (1) can be up to 95% or higher, the trivalent chromium content in COPRs is below 1.2% by weight (counted as Cr₂O₃), and the hexavalent chromium content in COPRs is even lower than 0.1% by weight (counted as Cr⁺⁶). In Steps (2) and (3), the recovery efficiencies of NaOH and CH₃OH are as high as 96% and 98%, respectively. Especially, the final emission amount of COPRs is only 750 kilograms per ton of sodium dichromate product, much lower than that in the traditional soda-ash roasting process and no higher than that in the calcium-free roasting process.

Based on the cleaner process, a demonstrative pilot plant with an annual capability of 5000 tons of sodium dichromate is to be built up in Huangshi City, Hubei Province, China. The cleaner process has exhibited a promising prospect in the industrial production of sodium dichromate.

Keywords: chromite, pressure leaching, sodium dichromate, extraction, CH₃OH