

## Red Mud Issues in Vietnam

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### Abstract



Vietnam has planned to develop a bauxite, alumina and aluminum industry based on its abundant resources. The red mud is currently the subject of concern in Vietnam. Some small plants are currently producing aluminium hydroxide for few decades. A commercial scale alumina refinery was put into operation in 2012 and another one will be commissioned soon. Construction of the disposal sites, treatment and re-use, chemical composition and trace elements of the red mud of these projects are described.

**Keywords:** Red mud, disposal, alumina.

### 1. Introduction

According to the United States Geological Survey in 2010, Vietnam is estimated to hold the world's third-largest bauxite ore resources, after Guinea and Australia. The majority of resources of Vietnam is located in Central Highlands and has only been mined to a minimum extent. Bauxite is typically strip mined and is used to produce aluminum.

According to the estimation of Ministry of Industry and Trade of Vietnam, potential resources in the Central Highlands could amount to 11.0 billion tons but the proven reserves are only 3 billion tons (Figure 1). It is worthwhile to develop a large-scale bauxite mining, processing, refining and smelting industry in Vietnam, which is outlined in the ambitious Master Plan on Exploration, Mining, Processing and Use of bauxite ore for the period 2020 with an outlook to 2025 [2]. But alumina refining generates a huge amount of caustic waste, so-called red mud, and this becomes a major concern in this country.

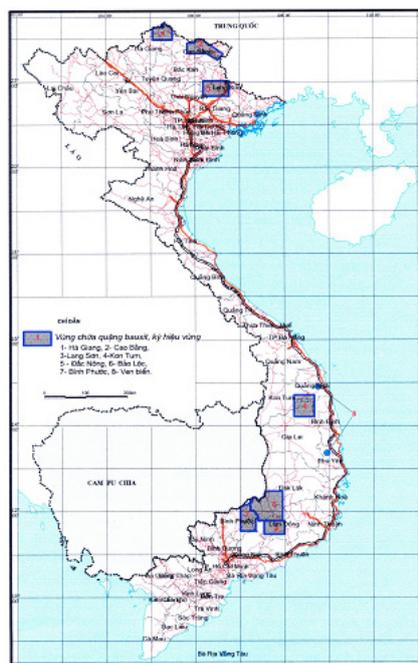


Figure 1. Bauxite Reserves Map of Vietnam [1].

## 2. Current Projects Generating Red Mud in Vietnam

Vietnam has indicated in the Master Plan that it needs about US\$15.6 billion to invest in major bauxite and alumina refining projects by 2025 to make use of its vast, largely untapped bauxite ore reserves, most of them in Central Highlands. At present, Vietnam has three projects generating red mud: Tan Binh Chemical Plant in Ho Chi Minh City, Tan Rai Refinery project in Lam Dong province and Nhan Co Alumina refinery project in Dak Nong province. The latter two alumina refinery projects are being built by China Aluminum International Engineering Co., (Chalieco), the engineering arm of the Aluminum Corporation of China Ltd (Chalco), in the frame of an EPC (Engineering, Procurement and Construction) contract.

### 2.1. Tan Binh Chemical Plant of Vinachem's Southern Basic Chemicals Company in Ho Chi Minh City

This plant has a history of nearly four decades. It produces nowadays 20 000 tons of aluminum hydroxide per year which is used as feedstock for chemicals for water treatment. The bauxite source is mined and beneficiated in the Bao Loc Mine, Lam Dong province. Tan Binh discharged around 40 000 tons of adherent liquor annually with the red mud in the past, this red mud was used mainly to leveling and landfill, causing negative effects to the environment. However, for the past 2 years, Tan Binh has discharged approximately 34 000 tons per annum of filtered red mud subsequent to the installation of a filter press from Japan with 4 tons/hour capacity. The filtered, almost dry red mud is used by other companies and individuals to make bricks, tiles, pigments and settling additives.

**Chemical composition of the red mud of Tan Binh:** Al<sub>2</sub>O<sub>3</sub>: 22.5 %, Fe<sub>2</sub>O<sub>3</sub>: 47.6 %, Na<sub>2</sub>O soluble: 0.05 %, SiO<sub>2</sub>: 4.8 %; moisture: 23 – 25 %, pH: 11.4 [3].

**Trace elements:** The Environmental Technology Laboratory of National University in Ho Chi Minh City has measured some trace elements of the Tan Binh dry red mud, including Sb: not measurable (< 0.001 mg/L), As: 0.060 mg/L, Ba: 0.012 mg/L, Ag: n.m. (< 0.001 mg/L), Be: 0.01 mg/L, Cd: 0.012 mg/L, Pb: 0.050 mg/L, Co: n.m. (< 0.001 mg/L), Zn: 0.064 mg/L, Mo: n.m. (< 0.001 mg/L), Ni: 0.026 mg/L, Se: 0.111, Ta: n.m. (<0.001 mg/L), Va: n.m. (< .001 mg/L), Cr: n.d (0.001 mg/L), Hg: n.m. (<0.001 mg/L), F: 0.201 mg/L. The values of all the above elements are much lower than the allowed threshold levels [3, 4].

### 2.2. Alumin Lam Dong Refinery (former Tan Rai Alumina Refinery) of National Coal and Minerals Industries Group (Vinacomin) in Lam Dong Province

This project is expected to be commissioned by the end of 2011 and to produce 650 000 tons of alumina per year from beneficiated bauxite mined in Tan Rai Mine, Lam Dong province. Table 1 shows the composition of the red mud from the Tan Rai project.

**Table 1. Composition of red mud and adherent liquor of Alumin Lam Dong Refinery.**

Red mud composition	%	Adherent liquor composition	g/l
Fe <sub>2</sub> O <sub>3</sub>	46.41	Na <sub>2</sub> O caustic	4.6
Al <sub>2</sub> O <sub>3</sub>	16.91	Al <sub>2</sub> O <sub>3</sub>	4.8
SiO <sub>2</sub>	6.60	Solid content in underflow from the last washer	550-650
TiO <sub>2</sub>	5.48		
Na <sub>2</sub> O combined	3.06		
CaO	4.48		
Others	17.06		
L.O.I	11.70		

Bauxite has been defined as an important resource for socio-economic development of the region. But, many scientists, environmentalists and cultural experts disagree and have expressed their strong concerns on the negative impacts of the mining. They also point out that the government exaggerates the economic benefits [8].

## 5. Conclusion

The huge bauxite potential of Vietnam is worth to develop to an industry of suitable size for the public and economic benefits. Using an up-to-date technology level environmental impacts caused by mining and refining could be overcome if the government imposes a sustainable, transparent and consistent policy that balances the interests of the areas of mining and beneficiation and locations of refining and smelting, and also the interests of the state, the companies and the public.

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