JDC CORPORATION

～Introduction to NLDH®～

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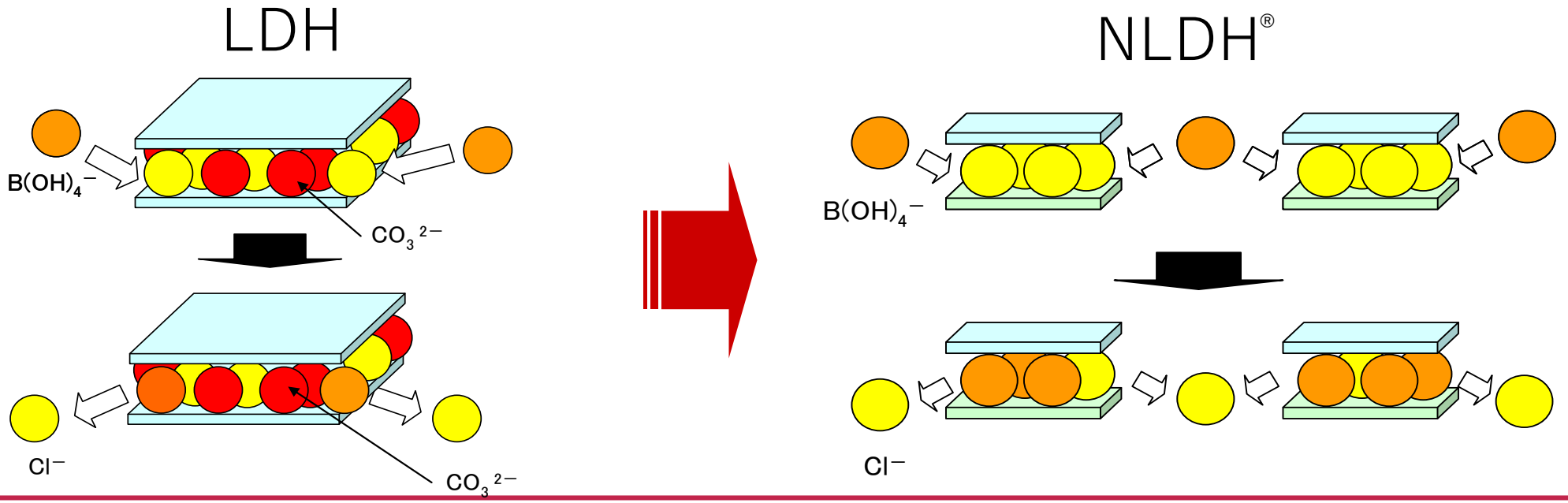
KOKUDO
MOVE EARTH, MOVE EVERYTHING
日本国土開発 株式会社

Summary of functional adsorbent (NLDH®)

NLDH® is a type of naturally occurring clay mineral called Layered Double Hydroxides (LDH).

We had begun to improve Layered Double Hydroxides, which is used as an anion remover, and succeeded in realizing nano-sizing of crystallites. With its higher anion adsorption capacity and versatility, we contribute to the solution of environmental issues by developing a Functional Adsorbent (Product name: NLDH®).

NLDH® is our special technique which can treat hazardous anionic heavy metals in industrial effluents or contaminated soils easily and safely. It is simple to produce NLDH®. In addition, since it is highly effective and inorganic compounds, NLDH® is environmentally friendly.



Technical Points of Functional Adsorbent (NLDH®)

- Inexpensive to produce
  Compared with an ion exchange resin on the market, NLDH® can be **manufactured at a reasonable cost.**

- Excellent adsorption power
  Compared with LDH on the market, NLDH® has a **higher adsorption capacity,** and additionally, it can **adsorb boron, fluorine, arsenic, and selenium.**

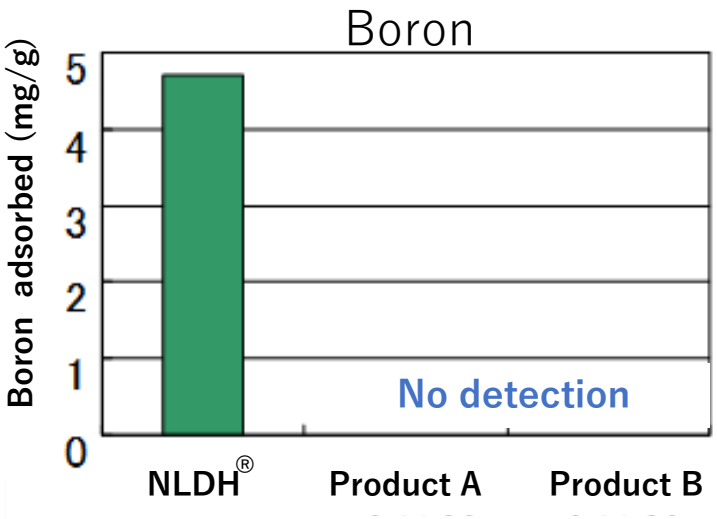
- Wide pH coverage
  Since its **pH coverage range from 3 to 11, there is no requirement to pretreat to control pH**.

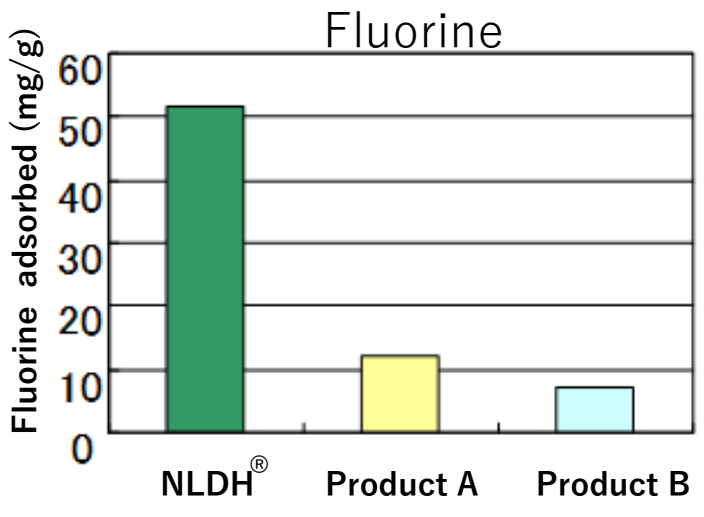
- Easy handling
  NLDH® is **non-corrosive and safe**. Corresponding to the purpose, you can choose NLDH®-P (powder) or NLDH®-G (granules).

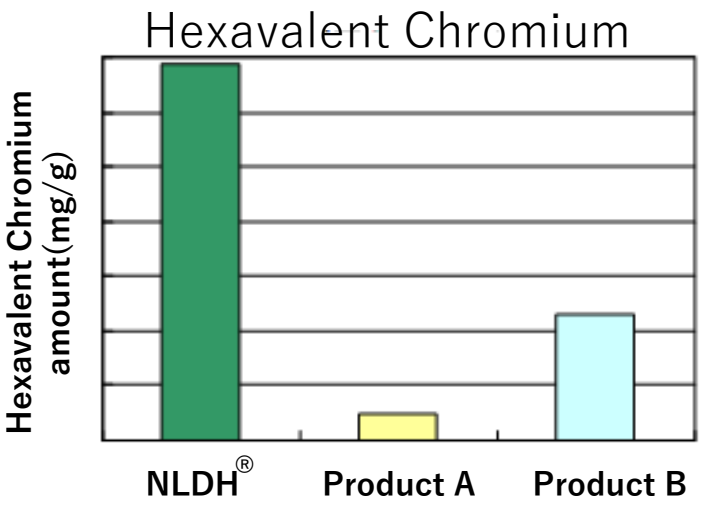
- Examples of Adoption in Japan
  1: to treat wastewater from thermal power plants
  2: to prevent the spread of heavy metals in contaminated soil

Adsorption Function of NLDH®

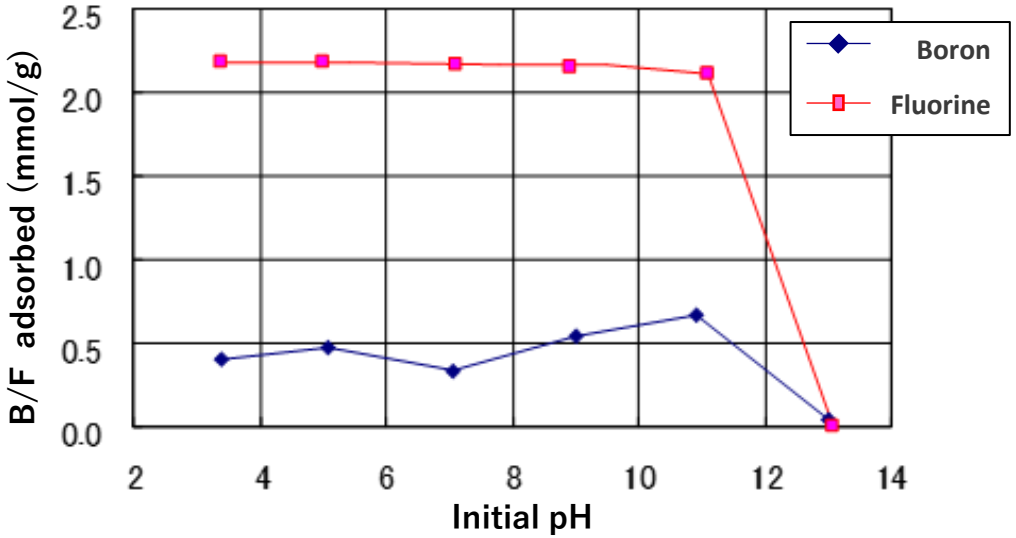
- Compare NLDH® with LDH (commercial product A/B) in the capacities of ionic adsorption







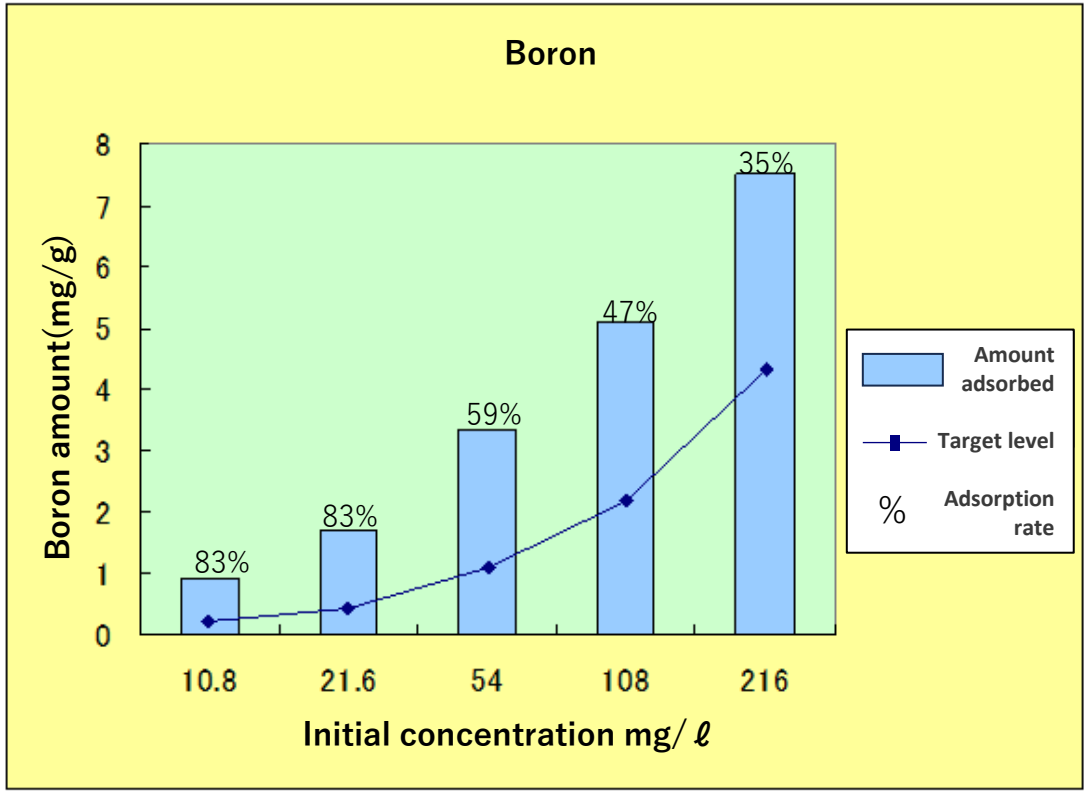
- pH dependent

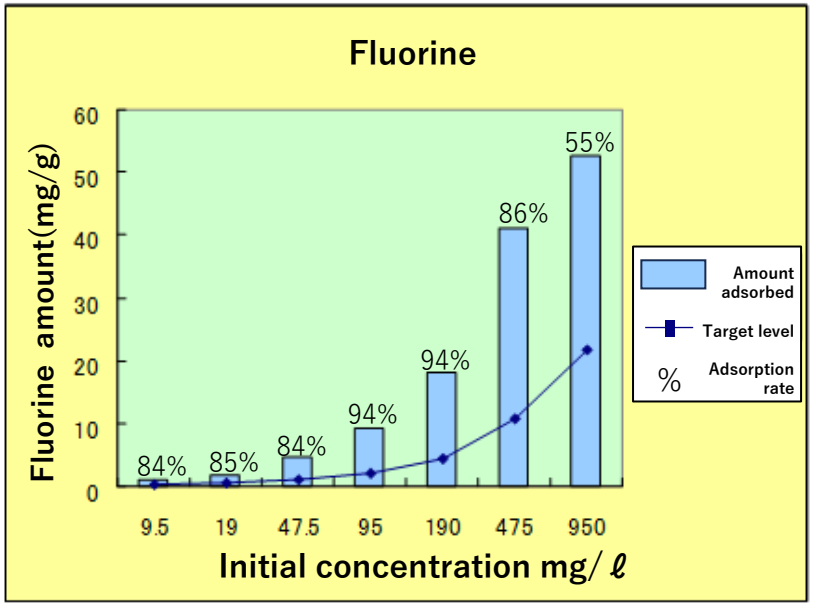


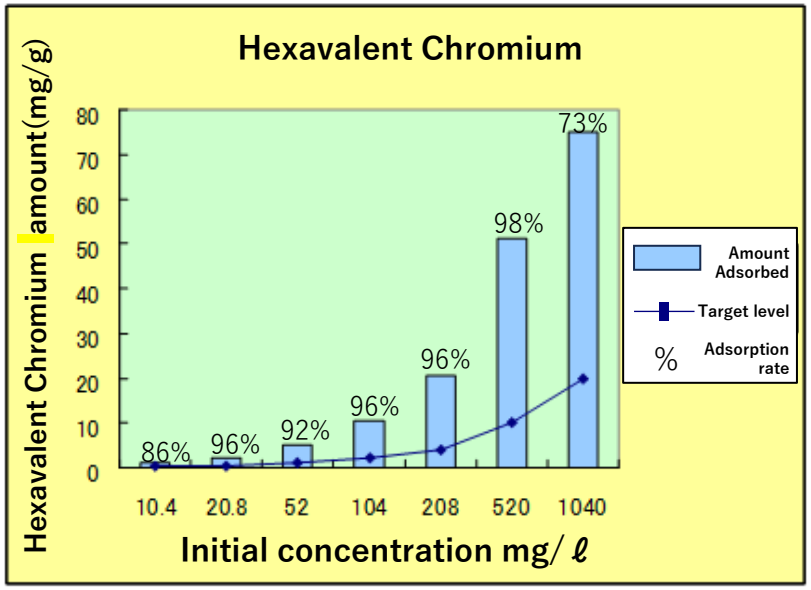
Advantages of NLDH®

- NLDH® has higher adsorption capacity than commercial products.
- There is no decrease in adsorption capacity for B/F in the initial range between pH 3 and 11.

Adsorption Function of NLDH® tests (Boron, Fluorine, Hexavalent Chromium)







- NLDH® shows high performance for B, F and Cr(VI) to achieve its target level; dosage 5%+ regeneration loss ratio 15%

Wastewater Treatment Process with NLDH®

Version1 (Normal)

Remove anions

Dispose harmful substances

Factories
(manufacturing plants)

NLDH®
Treatment
facilities

Wastewater
Treatment
facilities

River/
Sea

Dispose harmful substances

Remove anions

Factories
(manufacturing plants)

Wastewater
Treatment
facilities

NLDH®
Treatment
facilities

River/
Sea

Version2 **(only for overage anion)**

Factories
(manufacturing plants)

Wastewater
Treatment
facilities

River/
Sea

Operate only when
anion is overage

NLDH®
Treatment
facilities

History of NLDH®

	Details
2002 ～2004	・Joint research with Waseda University on leachate water treatment at final disposal sites ・**Developed nano-size layered double hydrocarbons (NLDH®)** ・Patent application for manufacturing method and its ability of heavy metal removal in 2004 (registered in 2011)
2005 ～2006	・Joint research with Waseda University on wastewater treatment at metal plating plants under METI's grant (Regional Revitalization Consortium)
2008 ～2013	・**Developed 'Wastewater treatment system by using layered double oxide'** and built a laboratory at JDC technical institute in Kanagawa under JST grant
2015	・Started technology exchange on mass production with partner companies
2018	・Transferred the laboratory to JDC Tsukuba office
2020	・Began to offer NLDH® technical assistance to the government of Bangladesh ・Constructed the first test plant (capacity: 8,000L/day) in Teota Union there
2021	・Signed a MoU with a Japanese company for comprehensive partnership

END