



# **Design and Simulation of Gas Storage Caverns from Underground Rock Salt Solution Mining**

**Professor/ Dean Na Tang**

College of Chemical Engineering and Materials Science,  
Tianjin University of Science & Technology,  
People's Republic of China

# Background

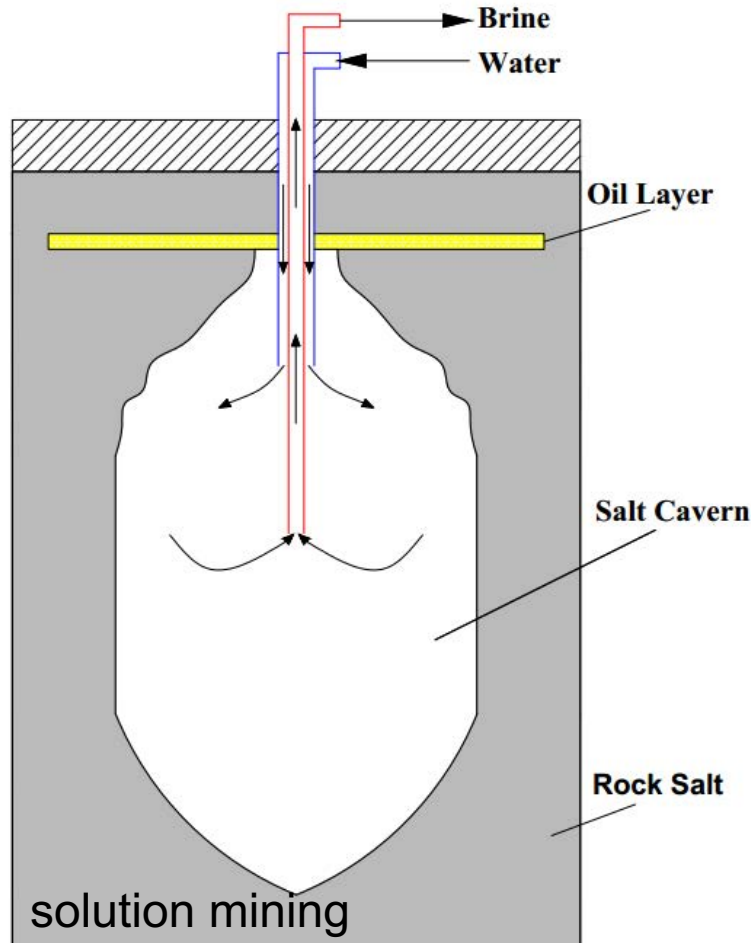
## Rock salt

Low permeability

Good mechanical properties

Solution in water

Abundant resources



Underground gas storage (UGS)

Underground storage

underground salt caverns

Loading pollutant

# Background

## Bedded Rock Salt



YK1-1井 第8次钻井取芯  
第十块: 693.33m~693.55m 灰白色泥质钙芒硝岩  
693.55m~693.65m 灰白色钙芒硝质盐岩



YK1-1井 第9次钻井取芯  
第三十五块: 707.92m~708.10m 灰白色石膏质盐岩  
708.10m~708.22m 灰白色泥质石膏  
708.22m~708.26m 灰白色盐岩

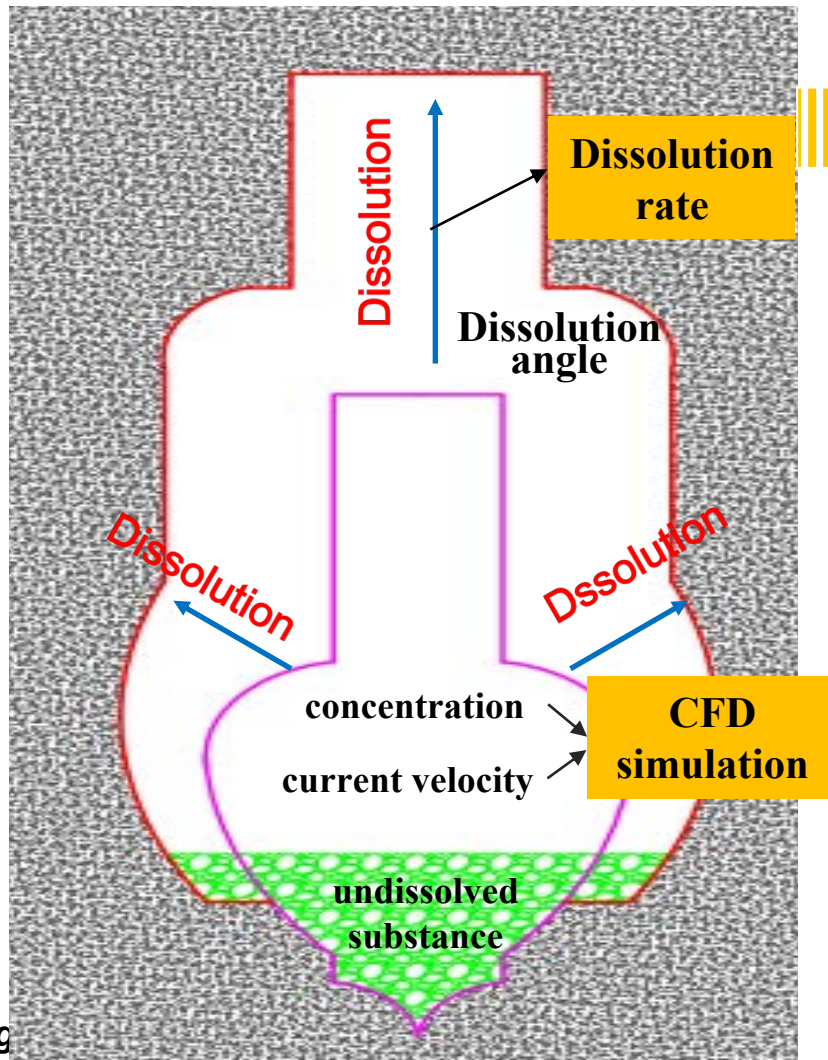
## Properties

- Thin bed
- Complex lithology
- Poor grade
- Multi-interlayer

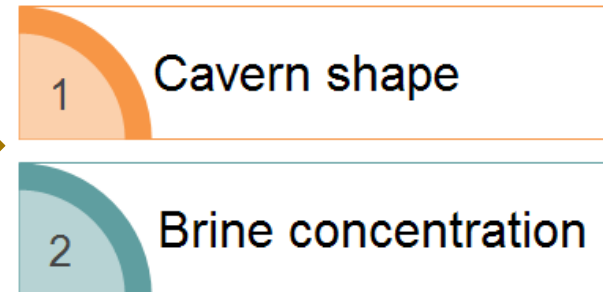
## Difficulties

- Slow building speed and long period of construction
- Low efficiency of cavern formation
- The shape of the cavern is difficult to control

# Purpose & Significance



regulate

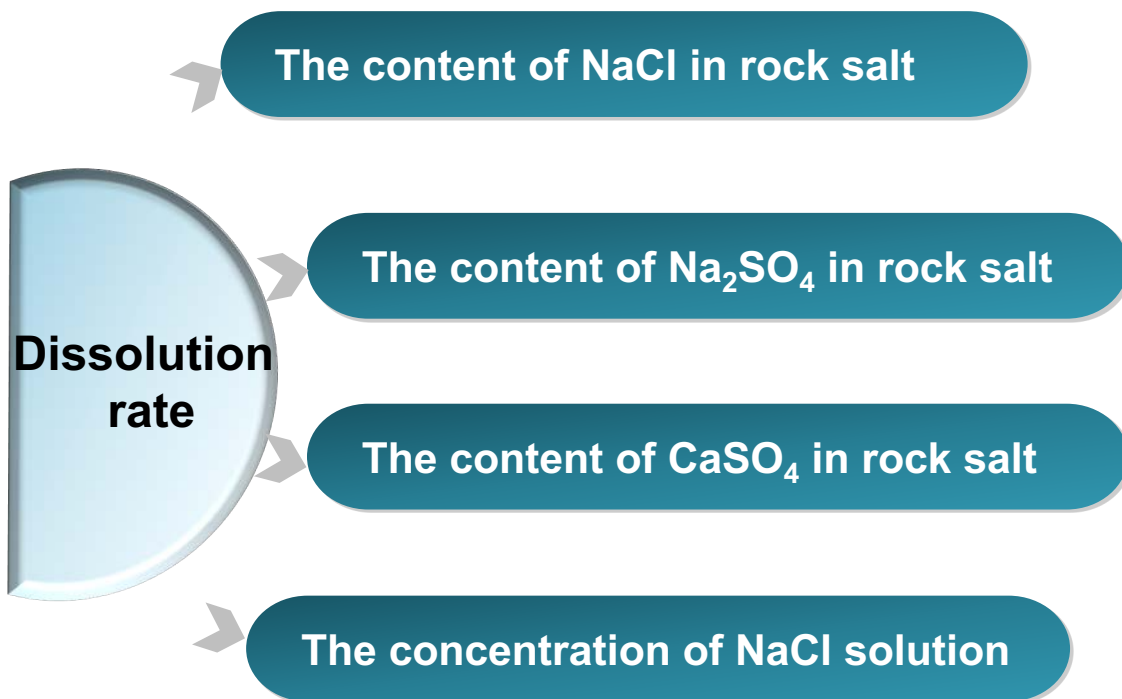




# Experiment approach



Hubei, Yunying area in China



# Experiment approach

**Dissolution rate**

$$v = \frac{C_2 V_2 - C_1 V_1}{S \cdot t}$$

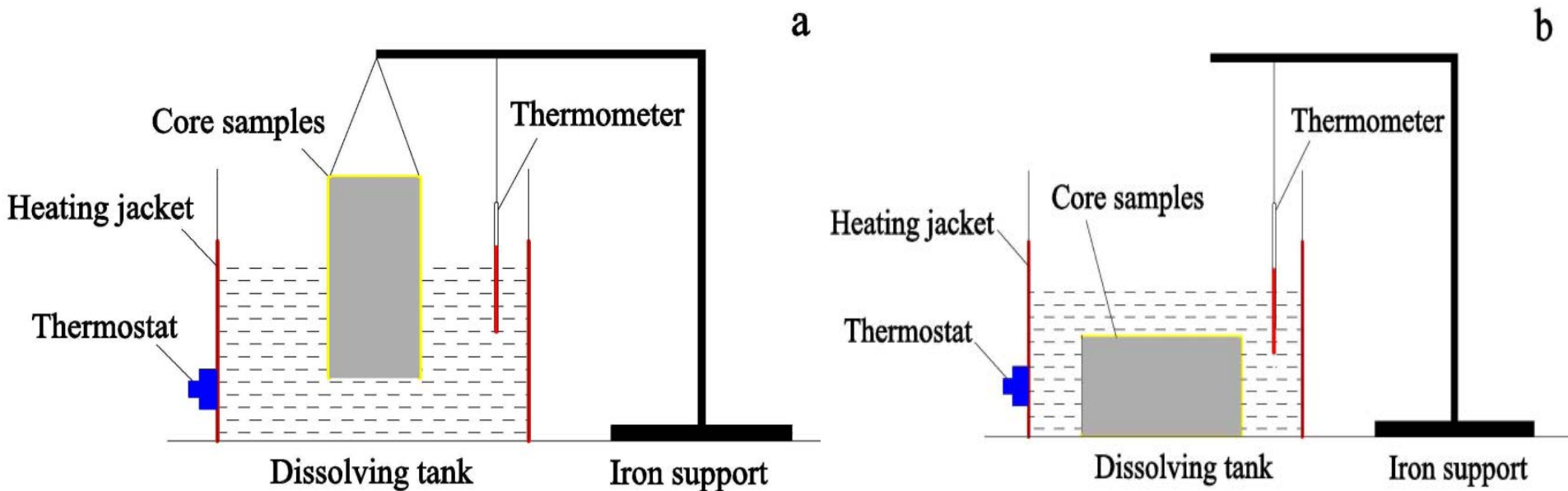


Fig.1. Schematic diagram of experimental equipment for salt rock dissolution  
(a - upward solution, b - lateral solution)



# Results and discussion

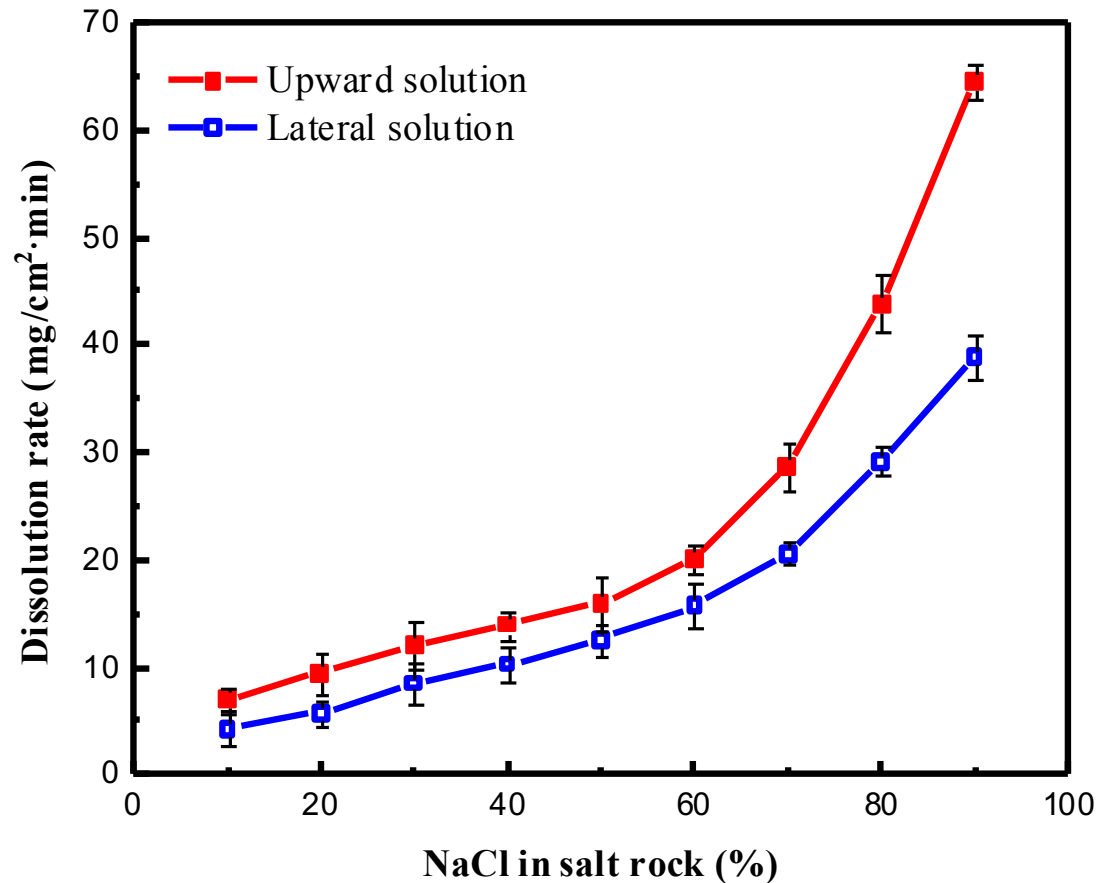


Fig.2. Effect of the content of NaCl in salt rock on dissolution rate



# Results and discussion

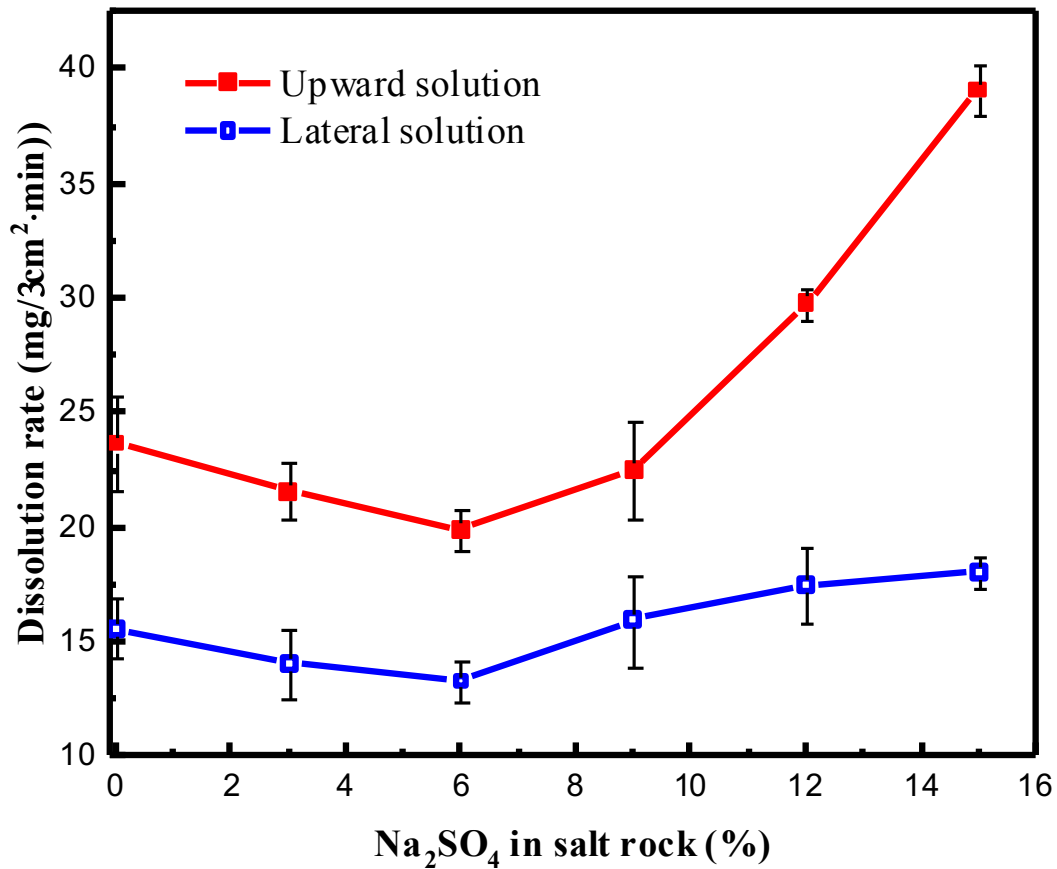


Fig.3. Effect of the content of Na<sub>2</sub>SO<sub>4</sub> in salt rock on dissolution rate





# Results and discussion

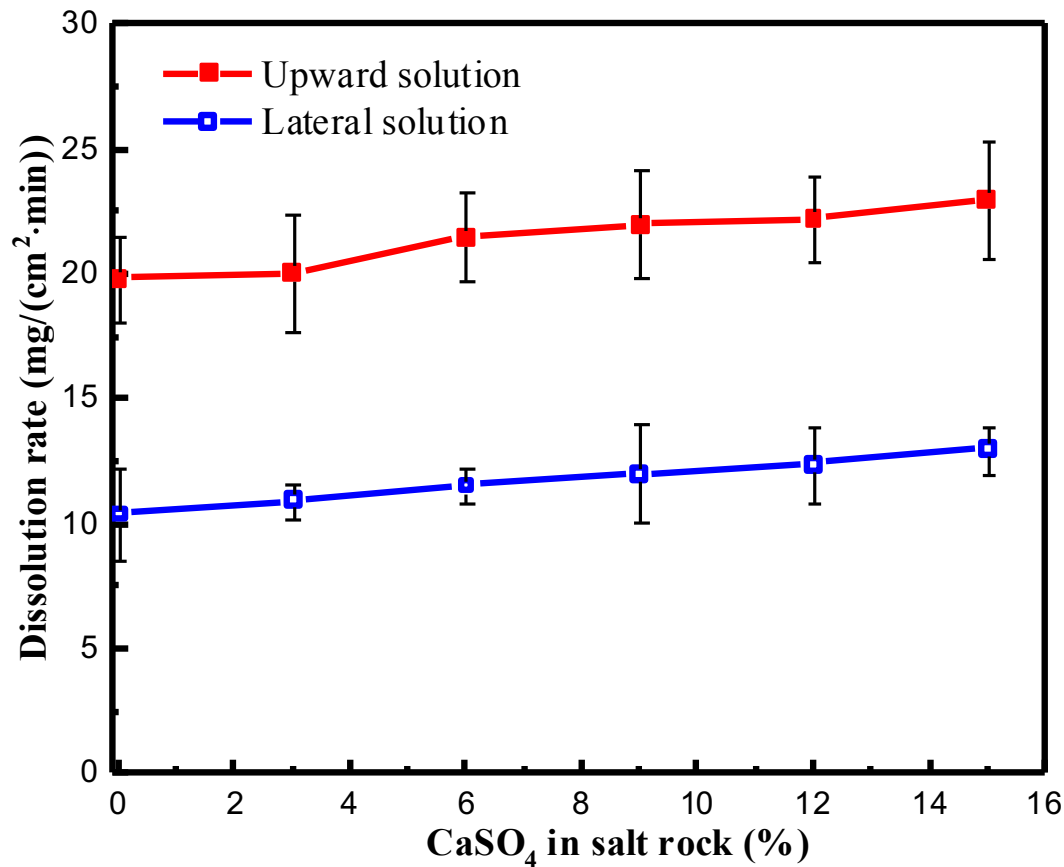


Fig.4. Effect of the content of CaSO<sub>4</sub> in salt rock on dissolution rate



# Results and discussion

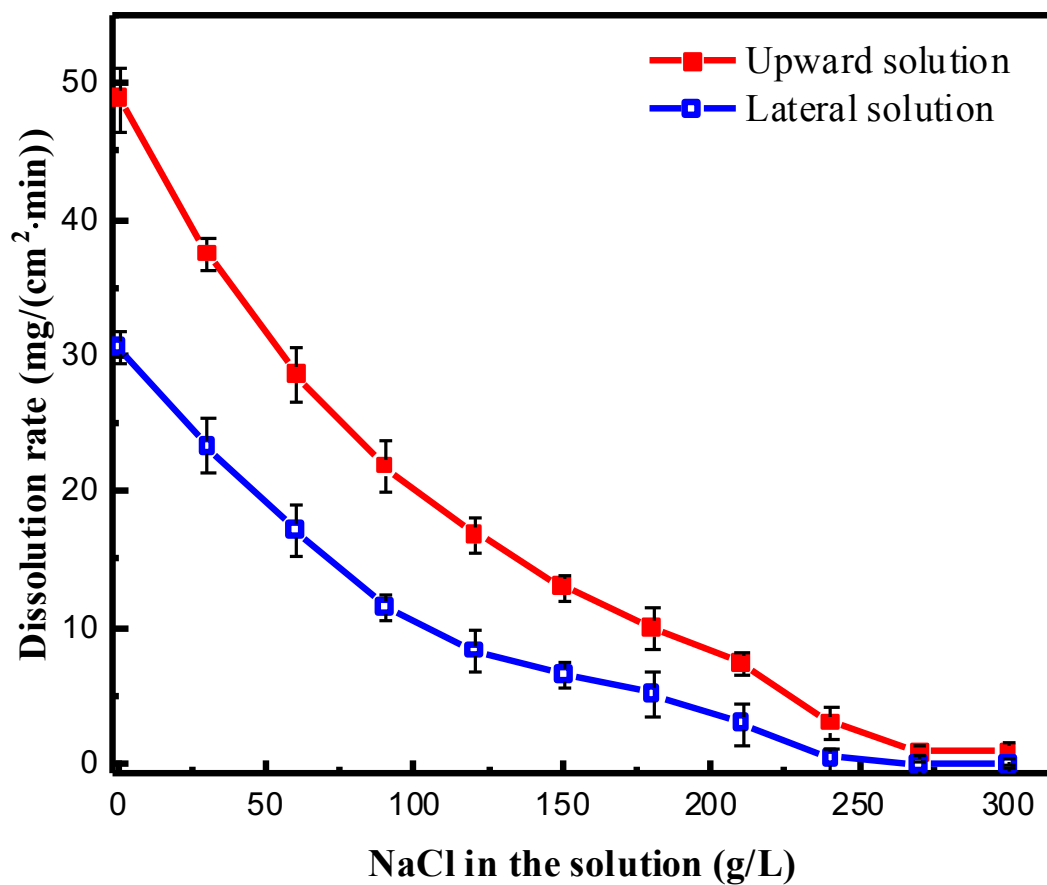


Fig.5. Effect of the concentration of NaCl solution on dissolution rate

# Conclusions

Dissolving characteristics of bedded rock salt were studied by numerical simulation and experimental.

- The increase of NaCl content in salt rock will promote the dissolution of salt rock.
- The dissolution rate of salt rock decreases first and then increases with the increase of  $\text{Na}_2\text{SO}_4$  content in salt rock.
- The content of  $\text{CaSO}_4$  in salt rock has little effect on the dissolution rate of salt rock.
- The increase in the concentration of NaCl in the solution will inhibit the dissolution of the salt rock.
- The dissolution mechanism of salt rock provide a theoretical basis for the synergetic control of the formation of groundwater rock and the formation of brine concentration on the ground.



**Thank you for your attention**