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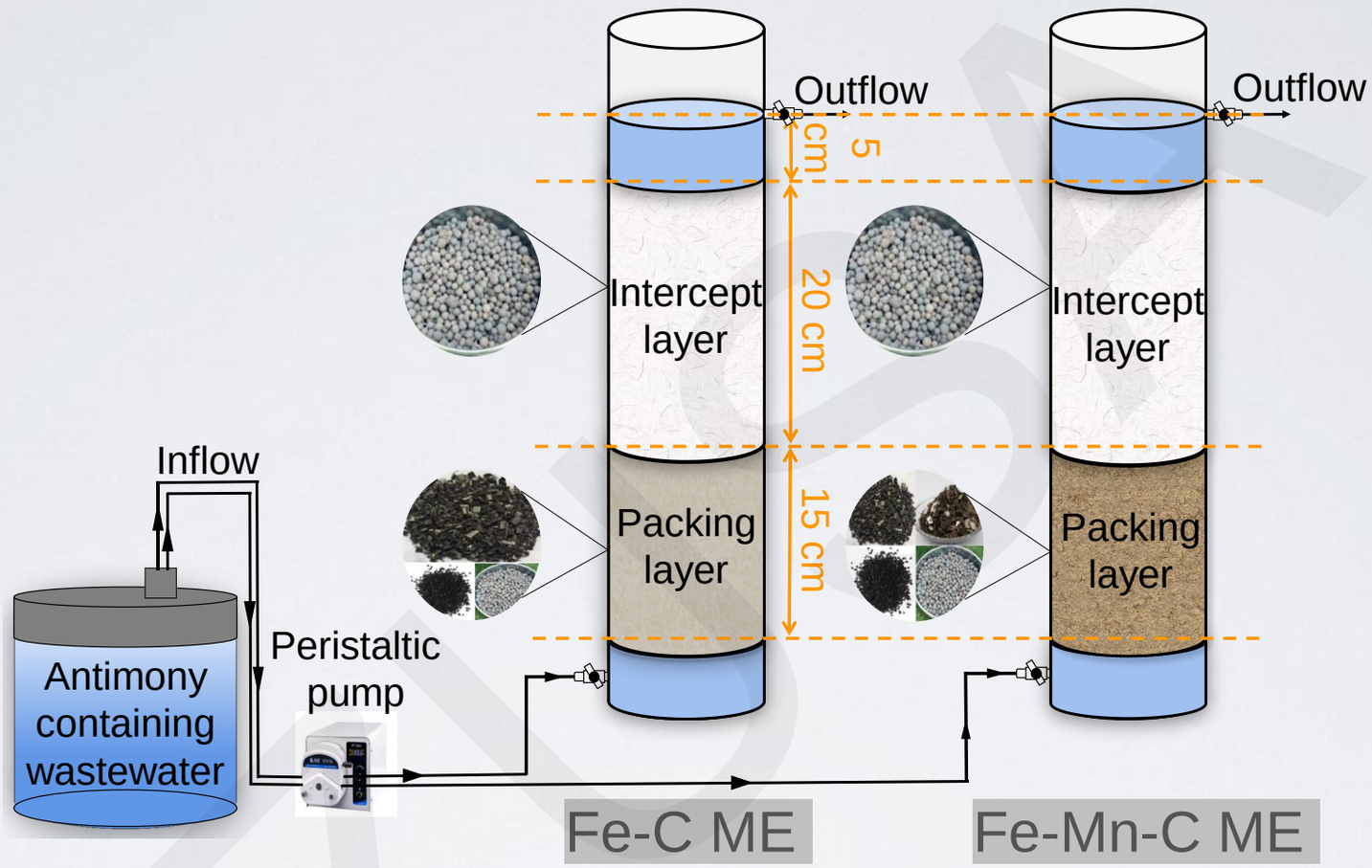
# Effective removal of Sb(V) from aqueous solutions by micro-electrolysis with composite scrap iron-manganese as filler

**Key words:**

Antimony; Iron; Manganese; Micro-electrolysis (ME); Electrochemistry; Mechanism



# Comparison of the removal effect of Sb(V)




| HRT | Fe-C ME | Fe-Mn-C ME |
|---|---|---|
| 8 | 66.0% | 65.5% |
| 10 | 68.0% | 77.6% |
| 12 | 72.3% | 79.9% |
| 16 | 80.1% | 88.5% |
| 24 | 79.1% | 87.0% |

Fe-Mn-C ME is 7.60%-9.67% higher than Fe-C ME

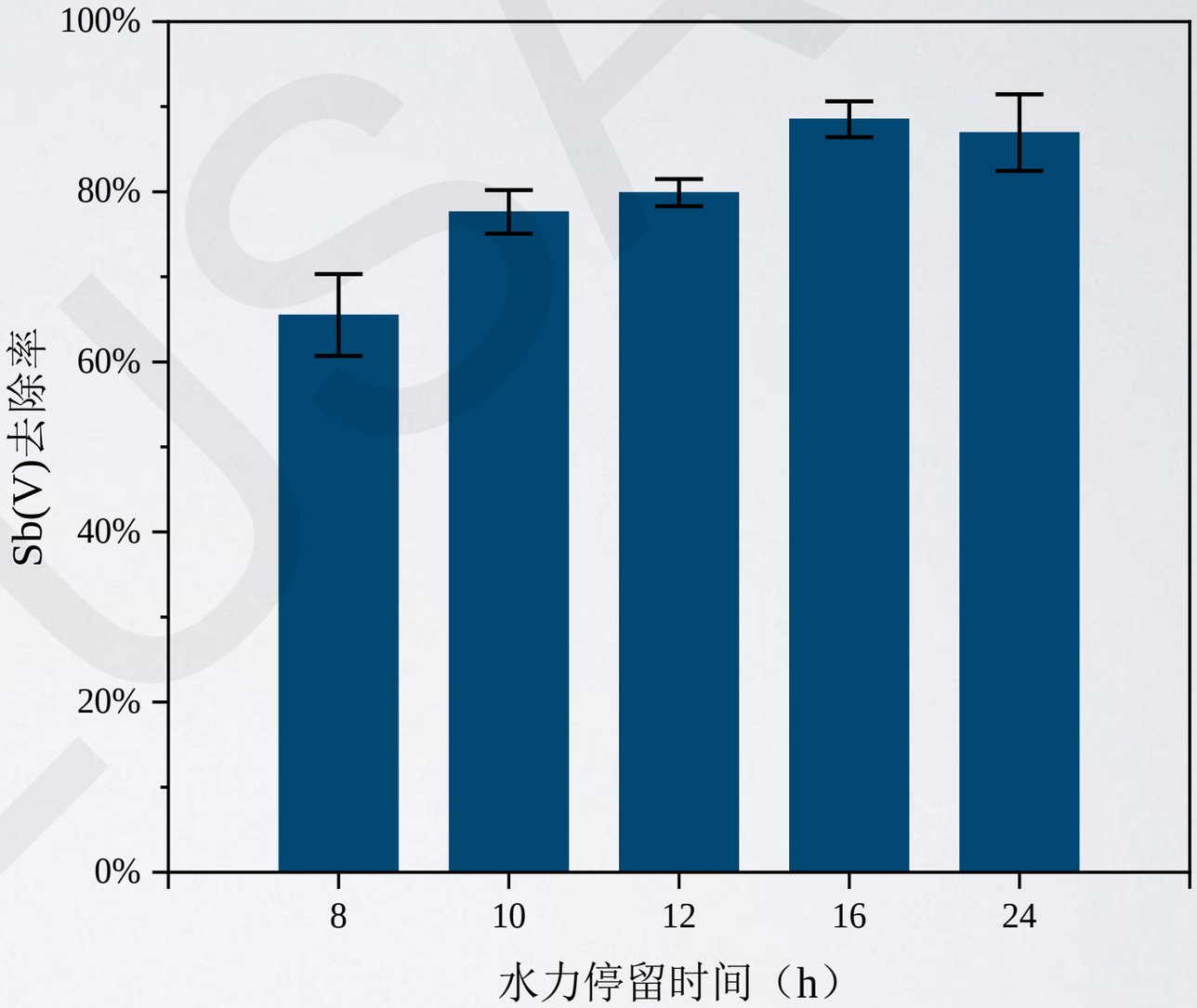
# Mechanism of increased removal rate

## Increase in potential difference

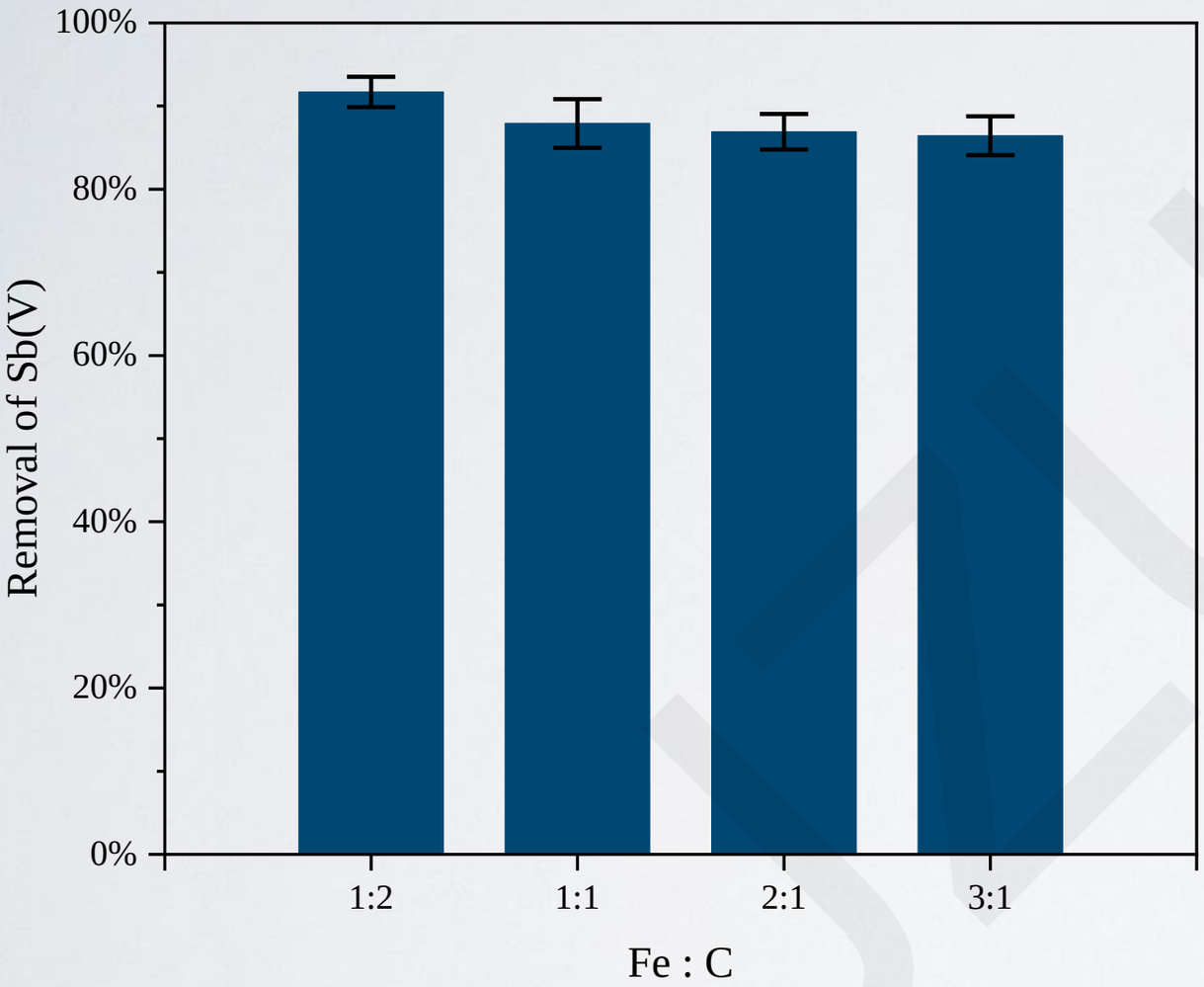
- The potential difference between Mn and C is three times that between Fe and C.
- The addition of Mn increases the potential difference of the electrolyte (Zheng Zibo et al., 2018)

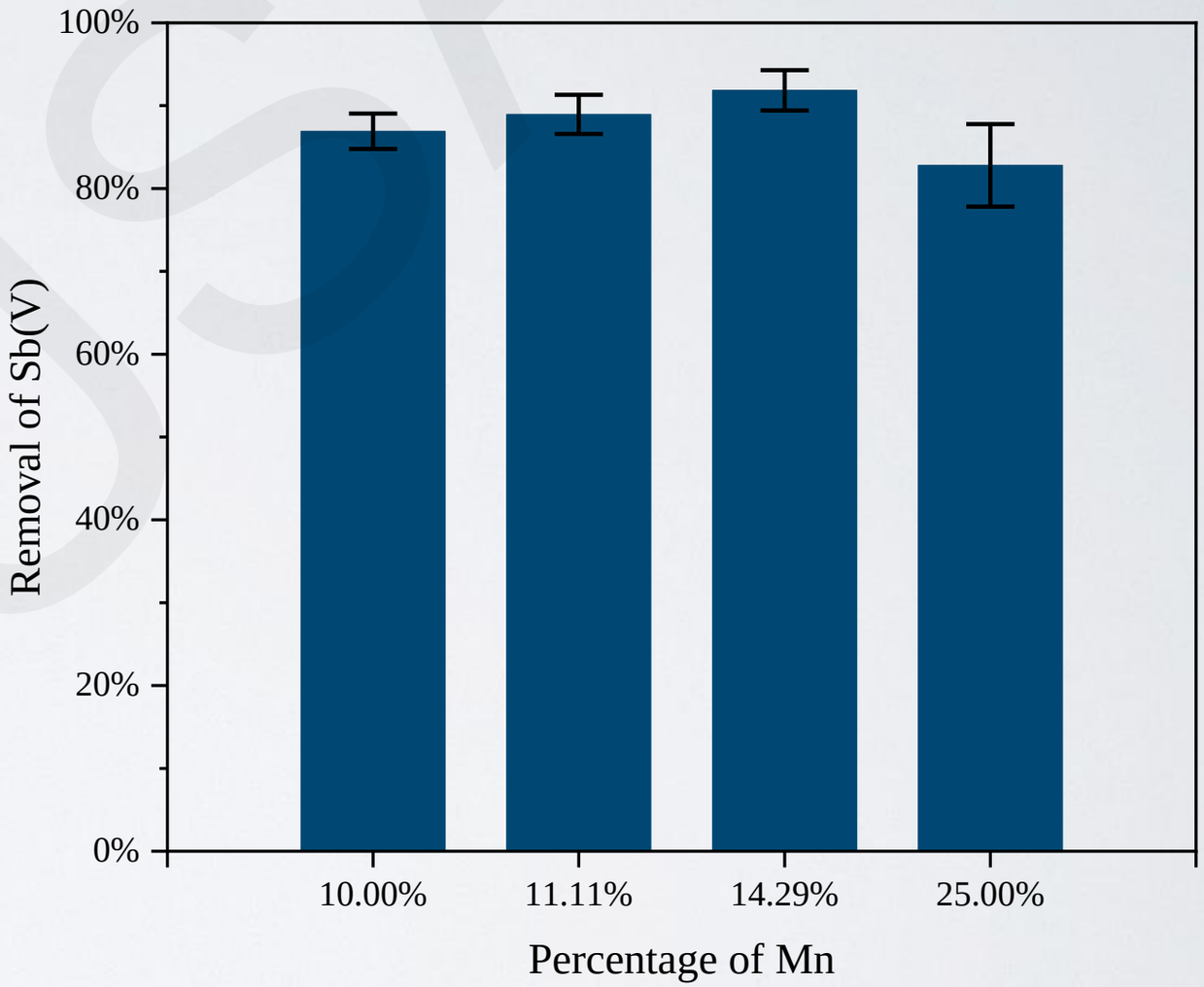
## Accidental Release

- Mn, as a good conductor of electricity, can promote the electron transfer between Fe and C, favoring the release of divalent iron ions (Jiang et al., 2017)

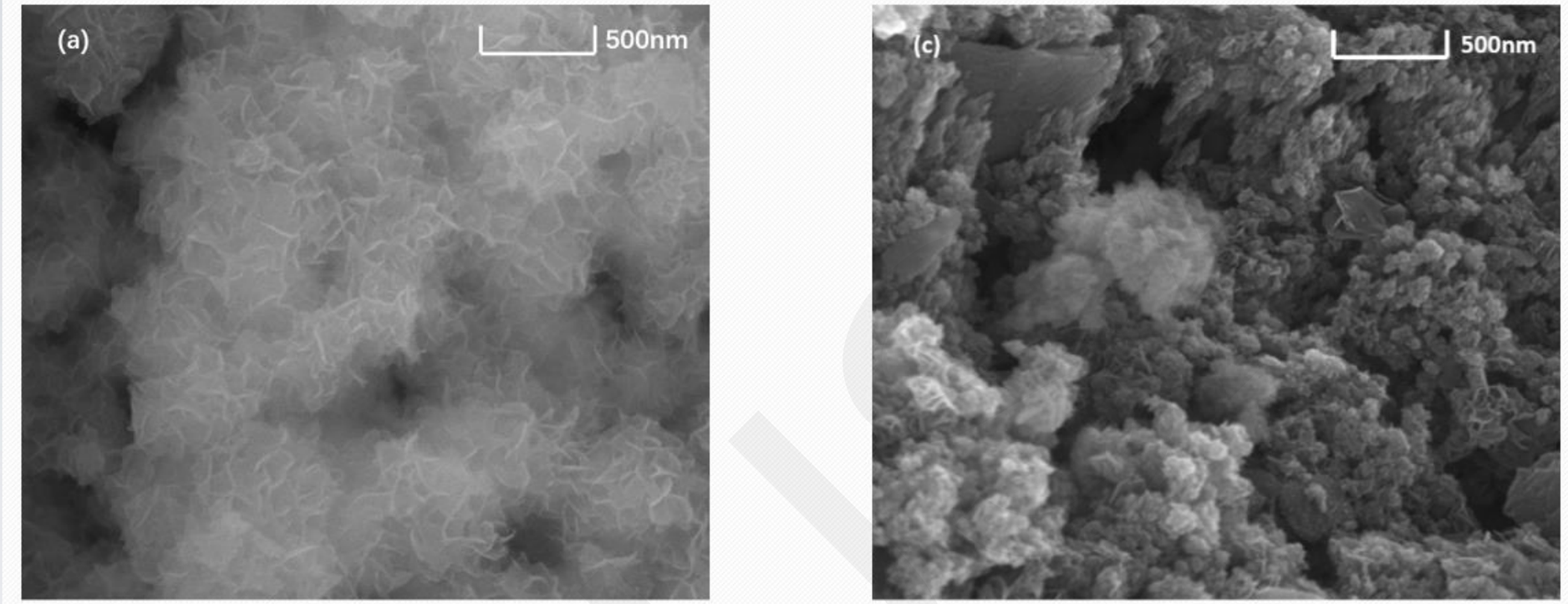


# Effect of Fe/C Ratio and Mn Content Percentage on the Removal Rate



# Characterization results




SEM images of flocs (a)  ferromanganese flocs (Mn content 14.29%) (c)Fe flocs

| Sample Type | BET Specific Surface Area ($m^2/g$) |
|---|---|
| Fe-Mn floc ( Mn 14.29% ) | 130.79 |
| Fe-Mn floc ( Mn 25% ) | 121.36 |
| Fe floc | 117.67 |

- The larger the area of the floc, the better the adsorption performance and the higher the removal rate.
- The specific surface area of Fe flocculent is lower than that of Fe-Mn floc.

# Mechanism of antimony removal by ferromanganese carbon microelectrolysis

## Electrode reaction

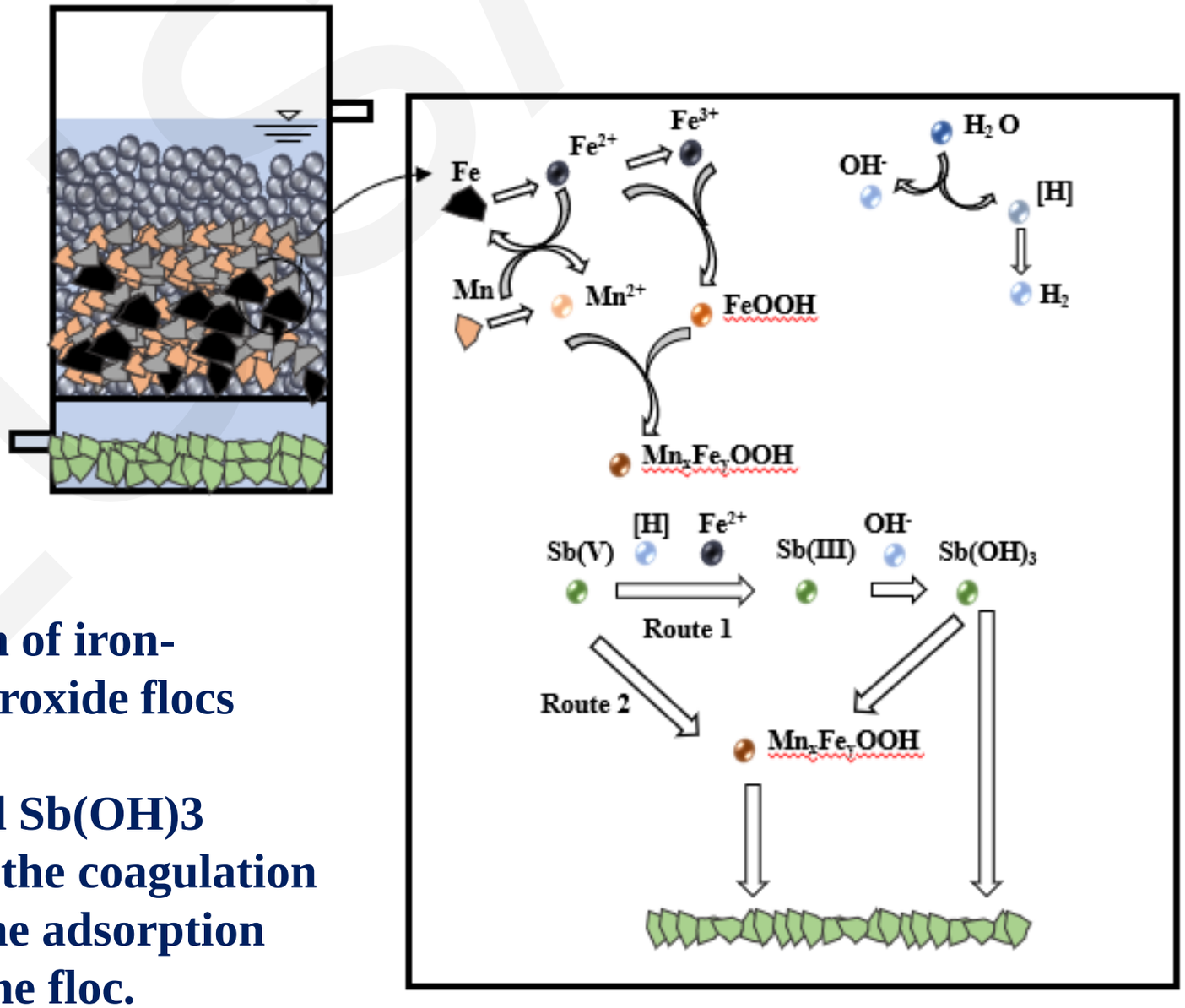
$$Fe\text{-}2e^- \rightarrow Fe^{2+}$$

$$Fe^{2+}\text{-}e^- \rightarrow Fe^{3+}$$

$$2H^+ + 2e^- \rightarrow 2【H】\rightarrow H_2$$

$$Mn\text{-}2e^- \rightarrow Mn^{2+}$$

$$Mn + Fe^{2+} \rightarrow Mn^{2+} Fe$$




## Adsorption

## Reduction

- Sb(V) was removed by adsorption of iron-manganese composite double hydroxide flocs
- Sb(V) was reduced to Sb(III), and Sb(OH)3 precipitate was generated during the coagulation process, which was removed by the adsorption and co-precipitation reaction of the floc.