

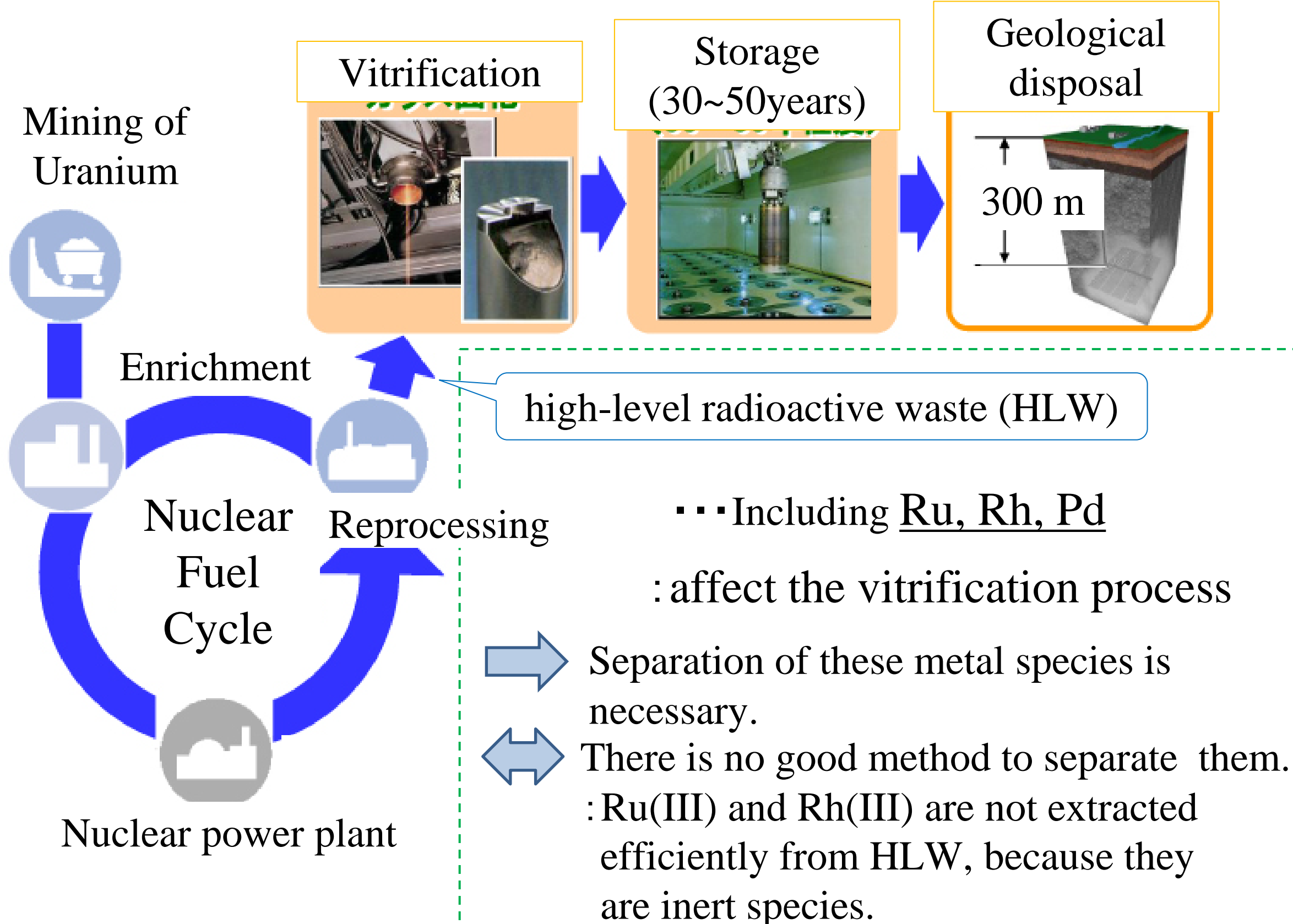
# マイクロ波と熱応答性イオン液体を用いた高レベル放射性廃液からの白金族元素迅速抽出法に関する研究

## Microwave-Assisted Homogeneous Liquid-Liquid Extraction of Platinum Group Elements from Nitric Acid Aqueous Solution to Thermomorphonic [Hbet][Tf<sub>2</sub>N] Ionic Liquid

Saki Ikeda, Takahiro Mori, Koichiro Takao, Yasuhisa Ikeda  
Research Laboratory for Nuclear Reactors, Tokyo Institute of Technology

### Introduction

#### Nuclear Fuel Cycle and vitrification



#### Thermomorphonic ionic liquid ; [Hbet][Tf<sub>2</sub>N]

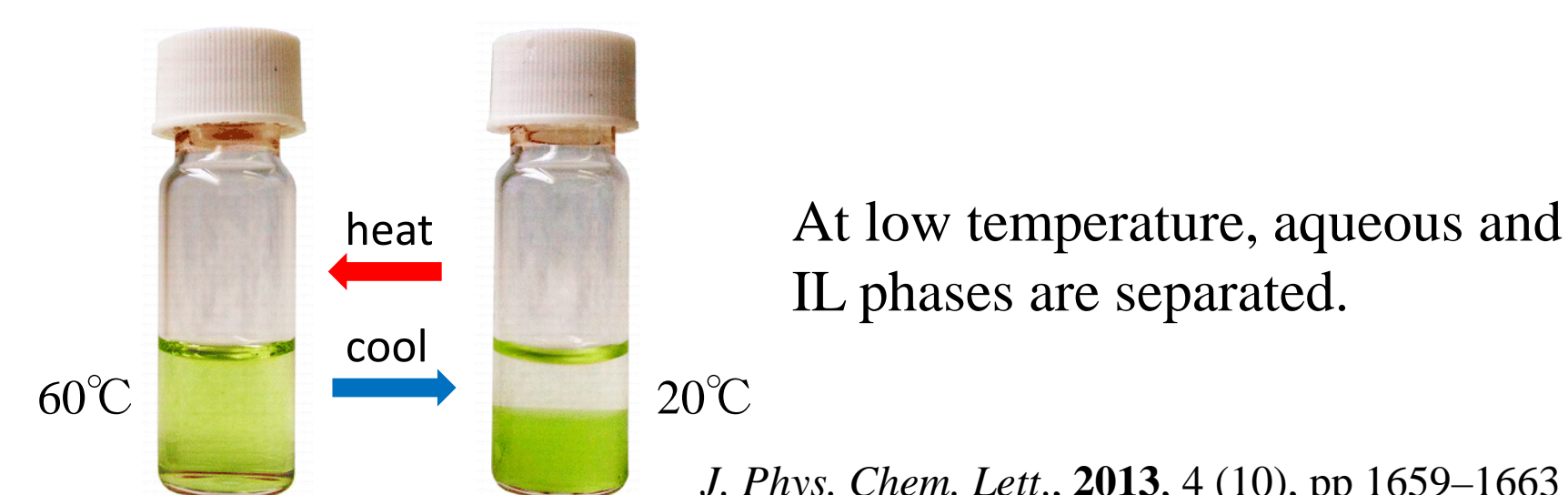
##### Ionic liquids (ILs)

- ◆ Ionic liquids are organic salts which are liquid at room temperature.
- ◆ Ionic liquids have unique properties;
  - Thermal stability
  - Non flammability
  - Low vapor pressure

##### [Hbet][Tf<sub>2</sub>N]

- ◆ [Hbet][Tf<sub>2</sub>N] consists of [Hbet]<sup>+</sup> and [Tf<sub>2</sub>N]<sup>-</sup>.
- ◆ Thermomorphonic ionic liquid : Liquid-liquid equilibrium of [Hbet][Tf<sub>2</sub>N] and H<sub>2</sub>O has upper critical solution temperature (UCST).
- ➡ [Hbet][Tf<sub>2</sub>N] is known as promising solvent for phase-transition extraction.

With increasing temperature, homogeneous phase is formed. Hence, fast reaction between the metal ion and the extractant can take place.



#### Microwave irradiation

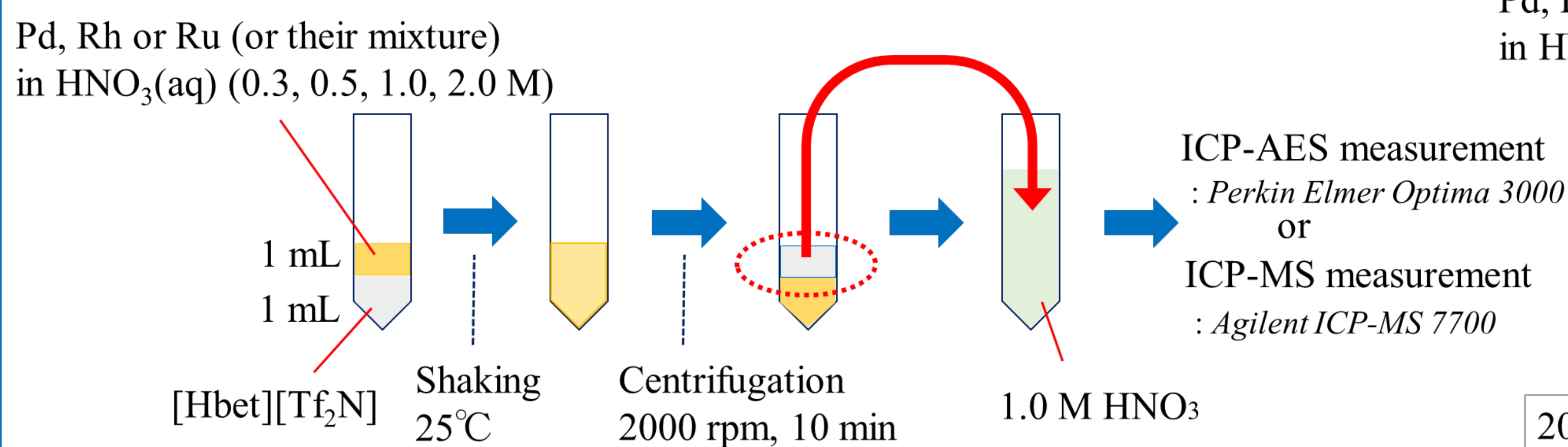
- ◆ Inductive heating
  - Energy saving
  - Rapid heating
  - extraction system using [Hbet][Tf<sub>2</sub>N] can be heated rapidly.
- ◆ Complex formation reactions of inert-metal species such as Ir(III), Ru(III) should be efficiently accelerated.

#### Objective

To examine the effectiveness of the microwave irradiation on extraction reactions of Ru(III) and Rh(III).

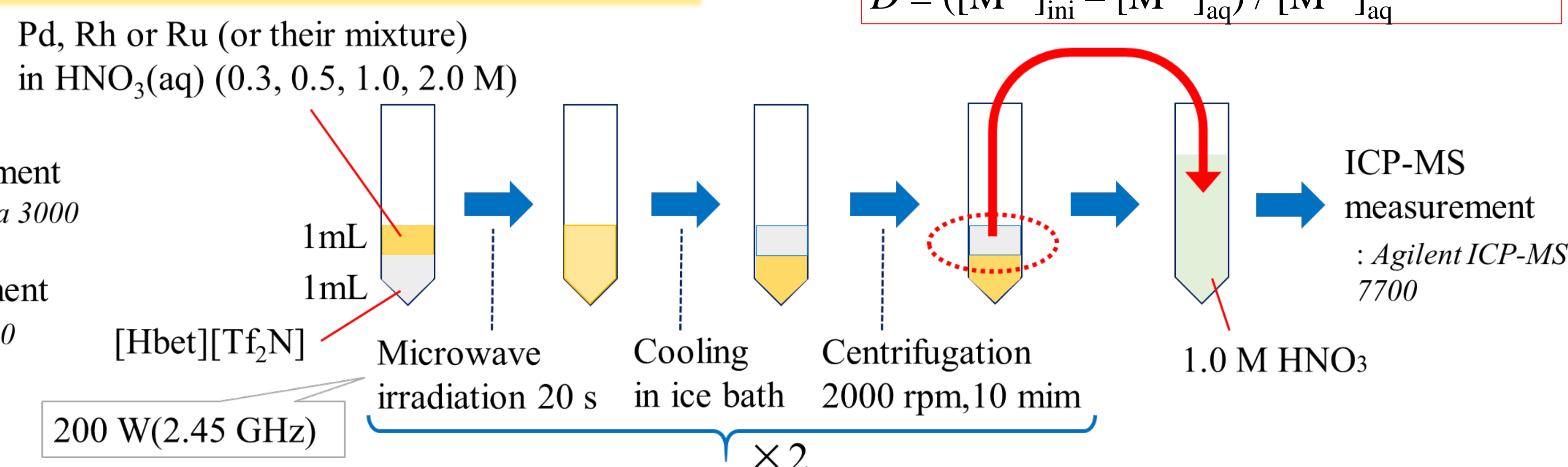
### Experimental - I

#### Liquid-liquid extraction



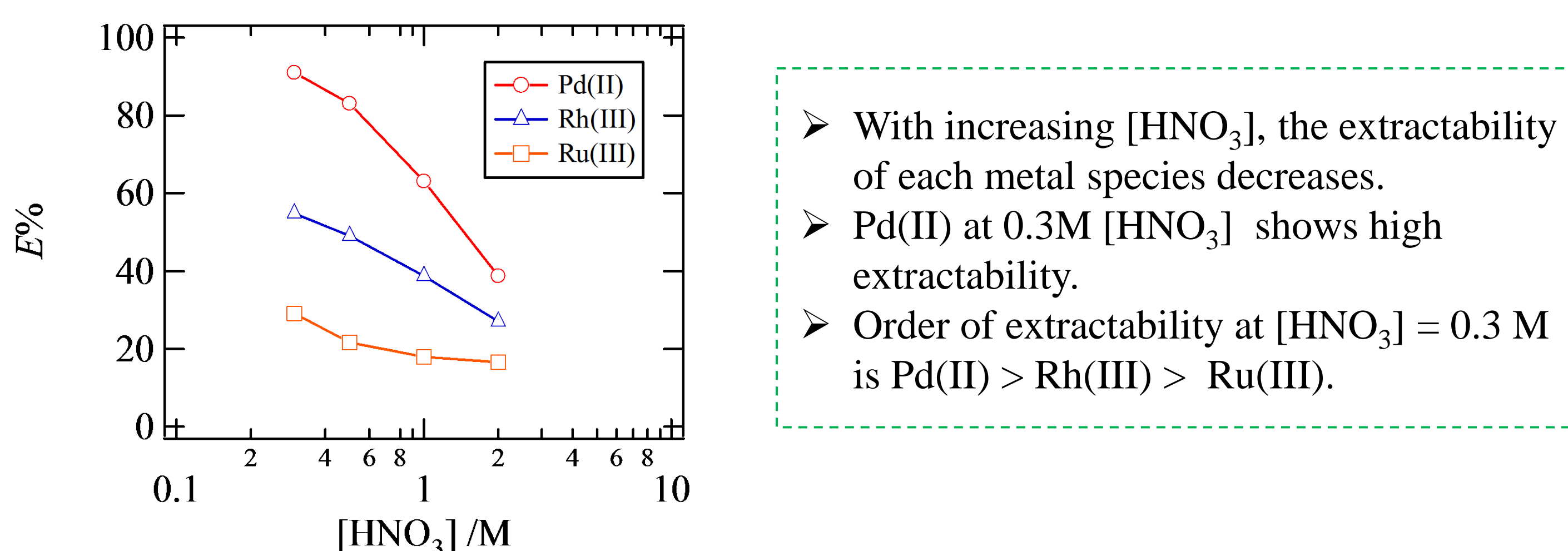
### Experimental - II

#### Microwave assisted extraction

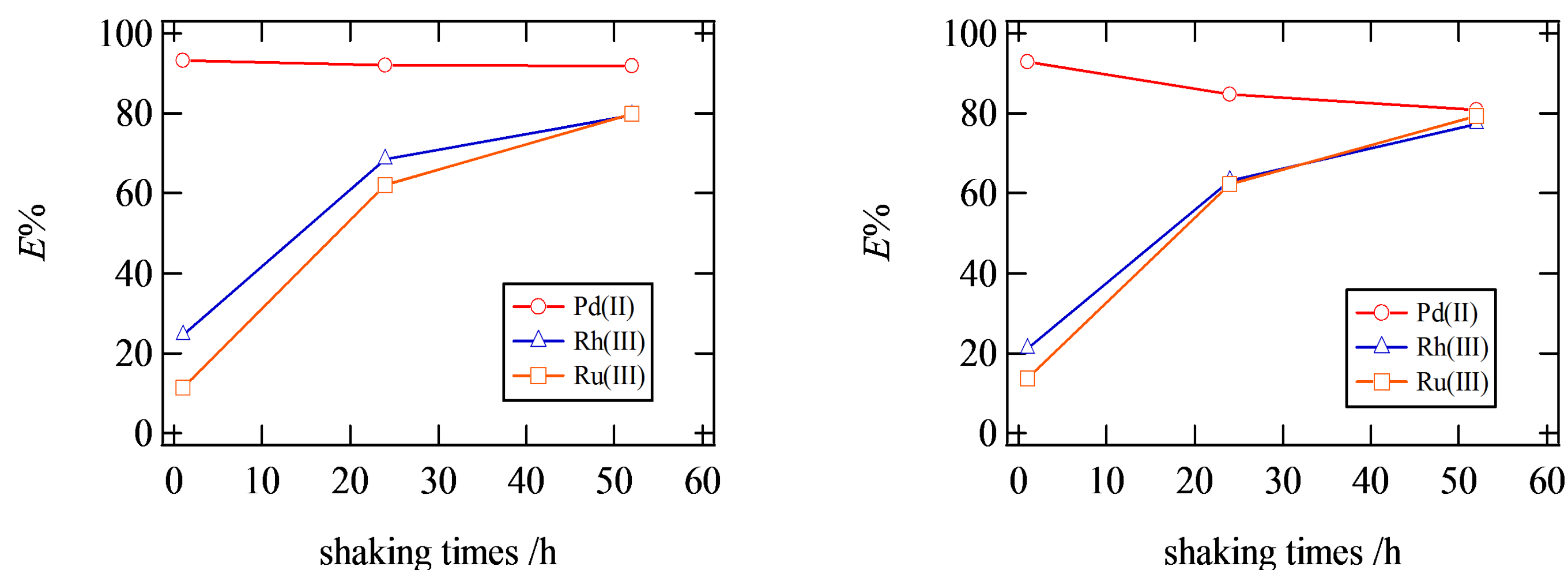


### Results & Discussion - I : Liquid-liquid extraction

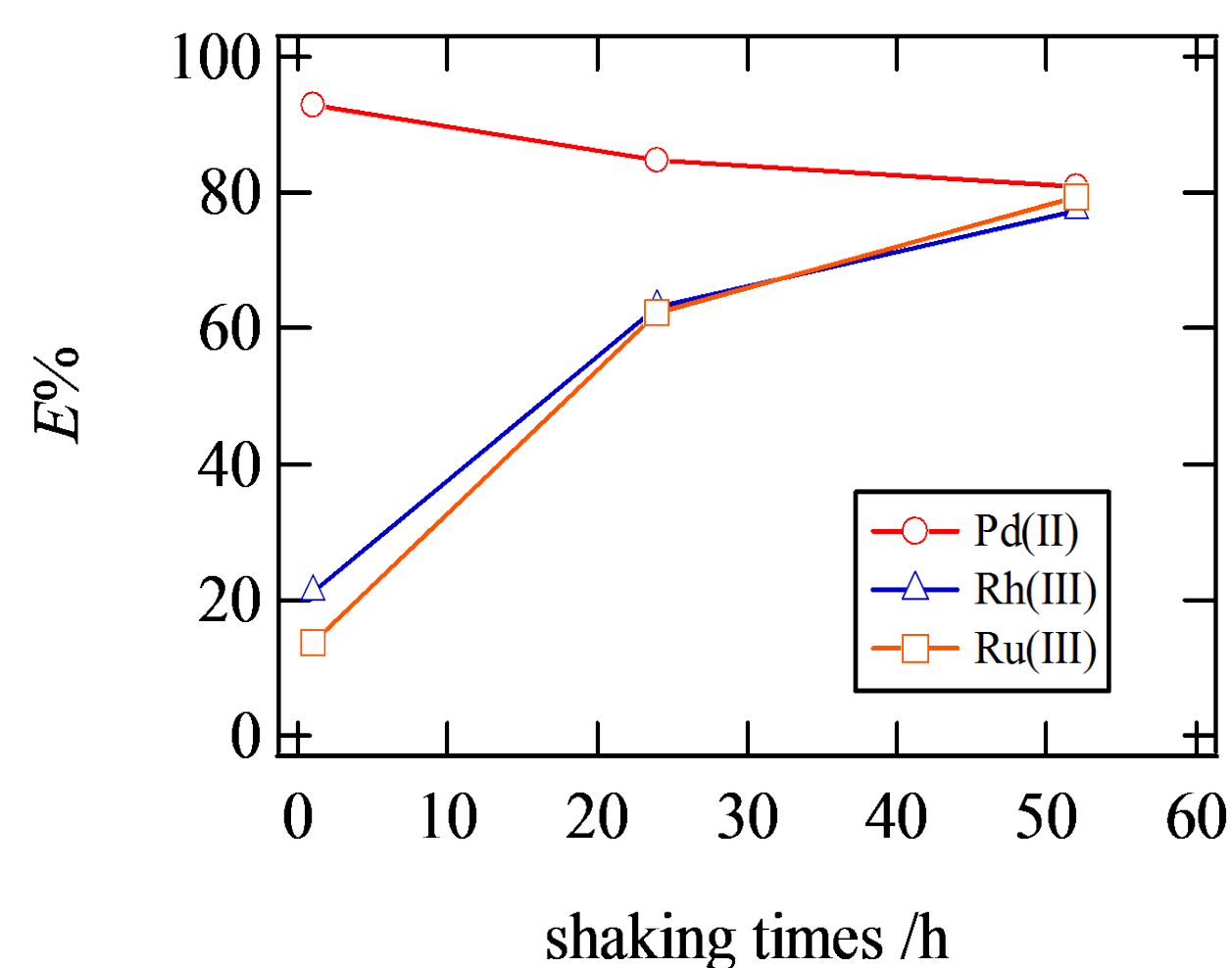
#### Single system



#### Single system

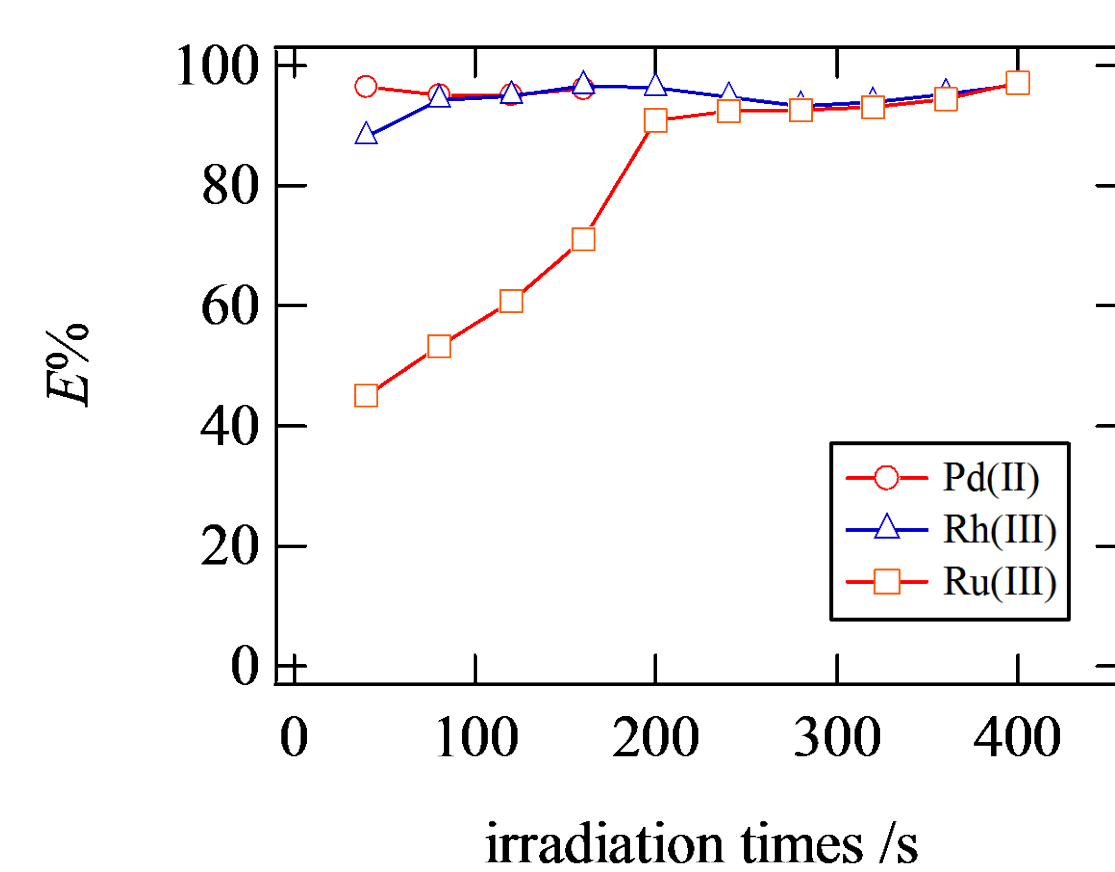


#### Mixed system

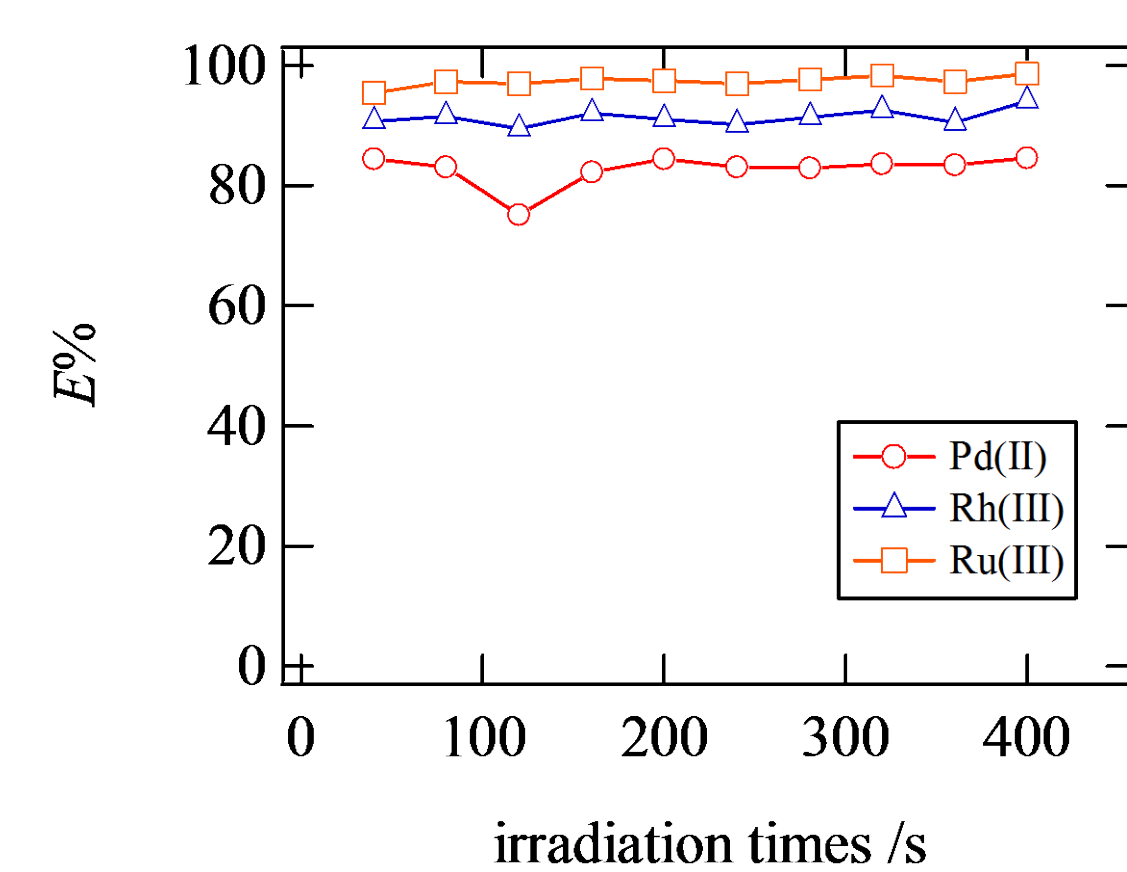


### Results & Discussion - II : Microwave assisted extraction

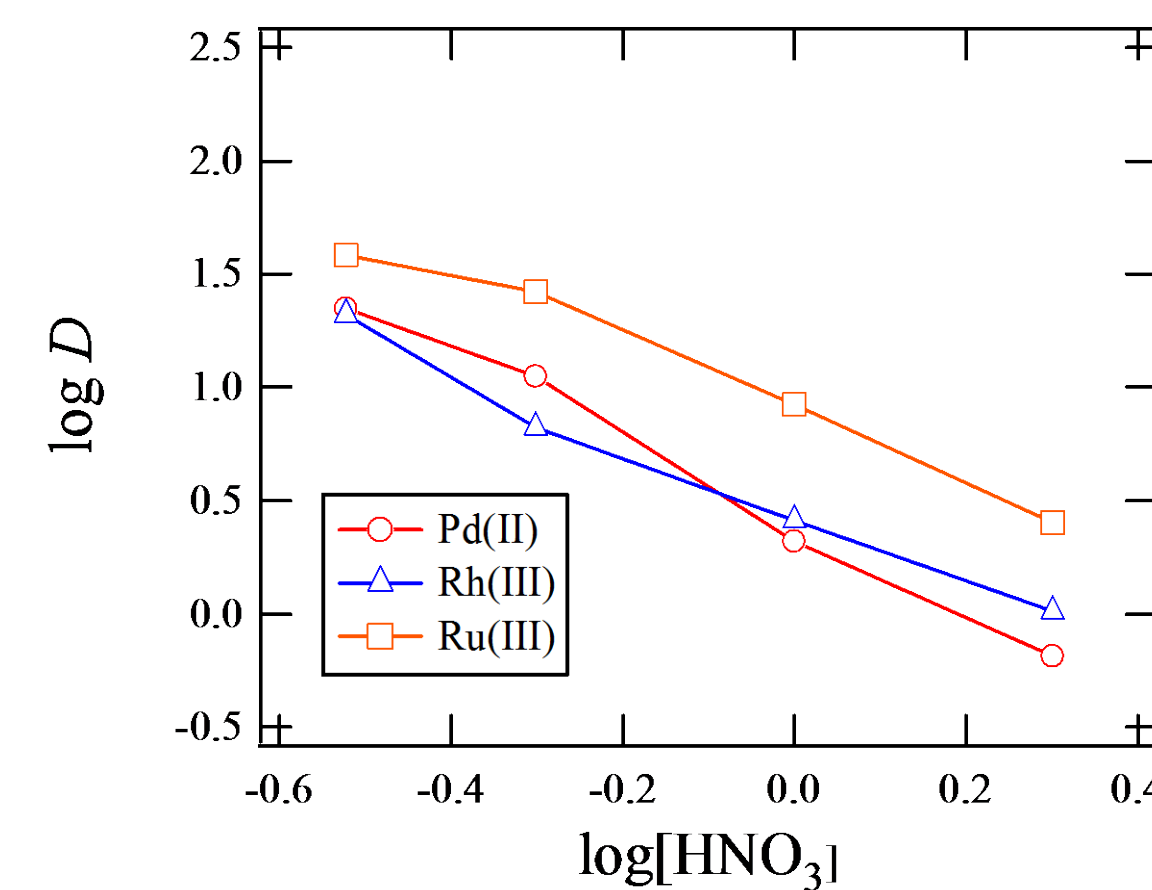
#### Single system



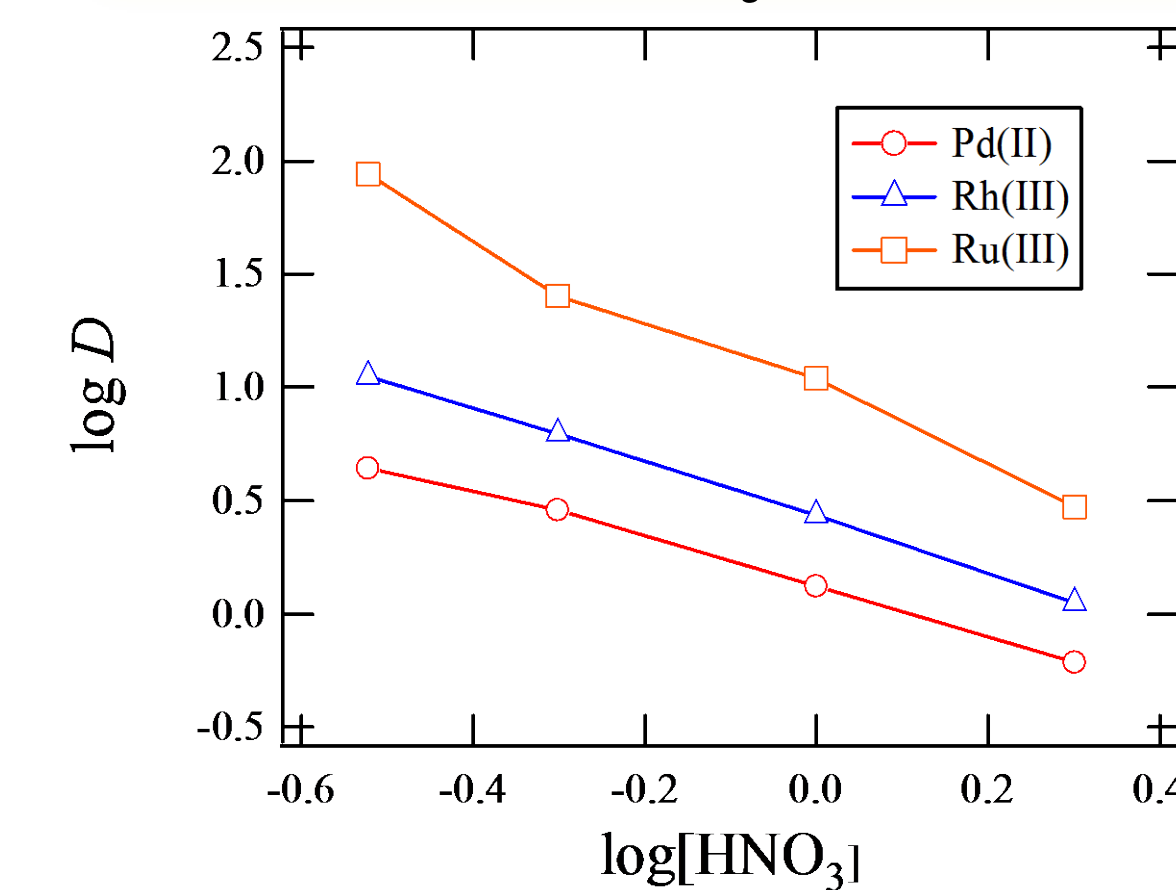
#### Mixed system



#### Single system



#### Mixed system



### Conclusions

- ◆ Microwave irradiation largely accelerates the homogeneous liquid-liquid extraction reactions of Rh(III) and Ru(III) in the HNO<sub>3</sub>(aq)-[Hbet][Tf<sub>2</sub>N] system.
- ◆ Especially, Rh(III) is efficiently extracted by microwave irradiation method.

### Future Works

- ◆ Detail studies on extraction mechanism.
- ◆ Mutual separation of Ru(III), Rh(III), and Pd(II).
- ◆ Investigation of new ionic liquids.