

論文 / 著書情報
Article / Book Information

Title	Development of Decomposition Device for Medical/Industrial Waste Gases using Dielectric Barrier Discharge
Authors	Kazuki Nakai, Shohei Moriya, Yuma Suenaga, Yuriko Matsumura, Atsuo Iwasawa, Akitoshi Okino
Citation	The 4th International Symposium on Biomedical Engineering, , ,
Pub. date	2019, 11

Development of Decomposition Device for Medical/Industrial Waste Gases using Dielectric Barrier Discharge

Kazuki Nakai¹, Shohei Moriya¹, Yuma Suenaga¹, Yuriko Matsumura², Atsuo Iwasawa² and Akitoshi Okino¹¹FIRST, Tokyo Institute of Technology Yokohama, Japan²Division of Infection Prevention and Control, Tokyo Healthcare University, Tokyo, Japan

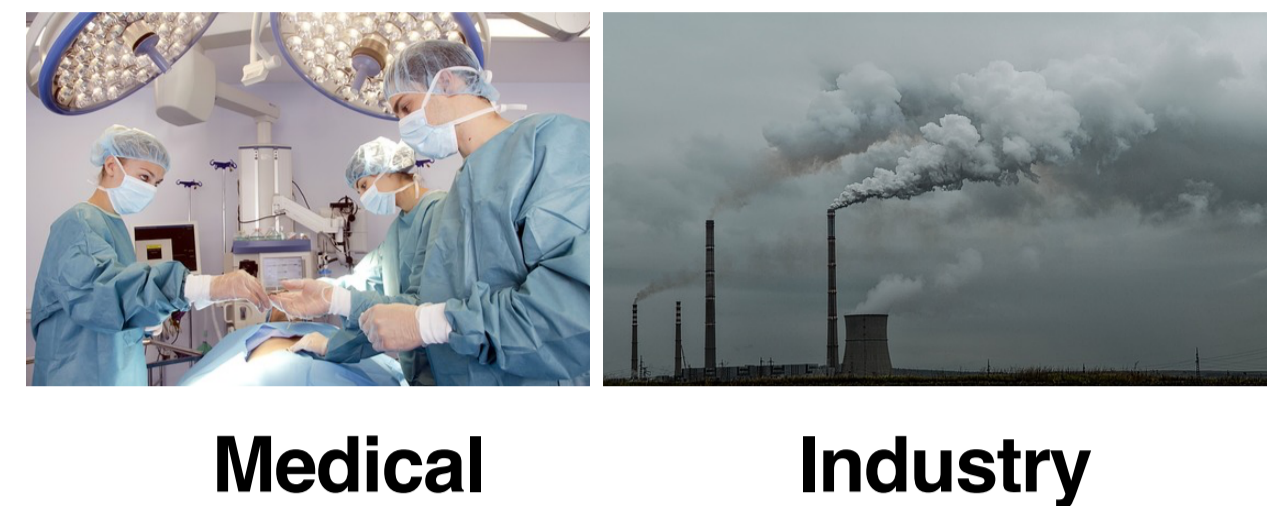
nakai@plasma.es.titech.ac.jp



1. Decomposition of atmospheric low temperature plasma

VOC gases Sevoflurane, Isoflurane, Toluene, Xylene etc...

Used anesthetic gas/industry exhaust VOCs are **low concentration** and **large volume**.



Medical

Industry

Decomposition method of VOCs

Combustion	○ Large volume and high concentration	
	✗ High power consumption	
Adsorption	○ Reusable	
	✗ Difficult for large volume	

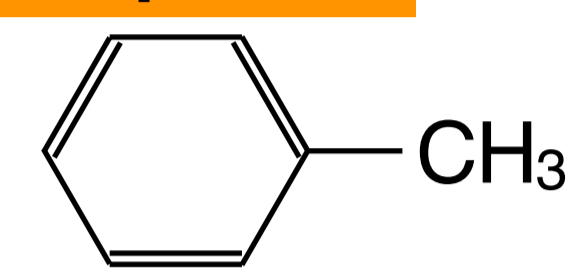
High efficiency decomposition device for low concentration/large volume VOCs is required.

Decomposition by atmospheric low temperature plasma

○ High energy electron/reactive species in low temperature plasma

○ Low energy consumption

In the plasma



VOC gases

+



Electron/Radicals



Final products

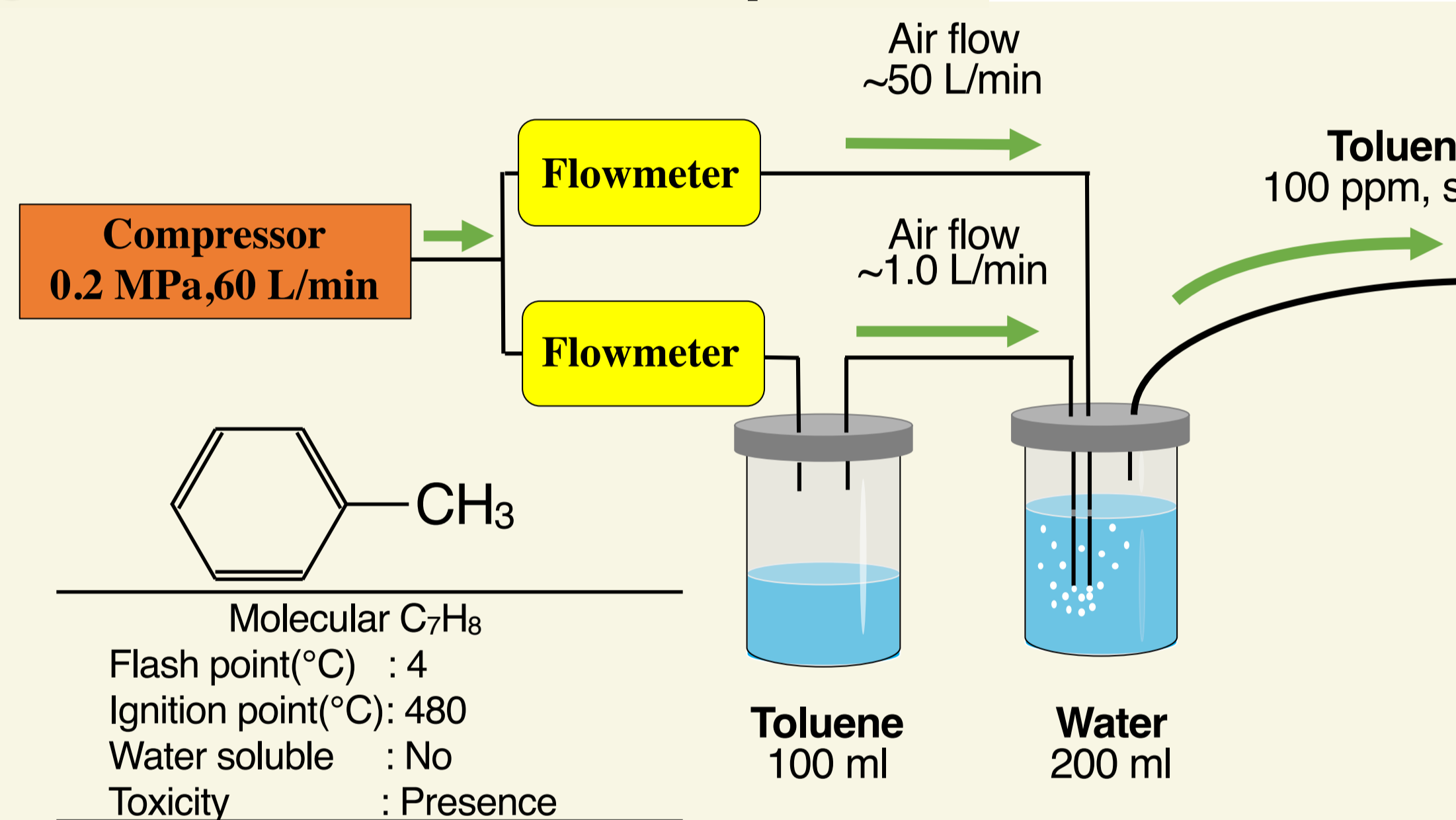
Development of decomposition device for **10,000 L/min** waste gases

In this study,

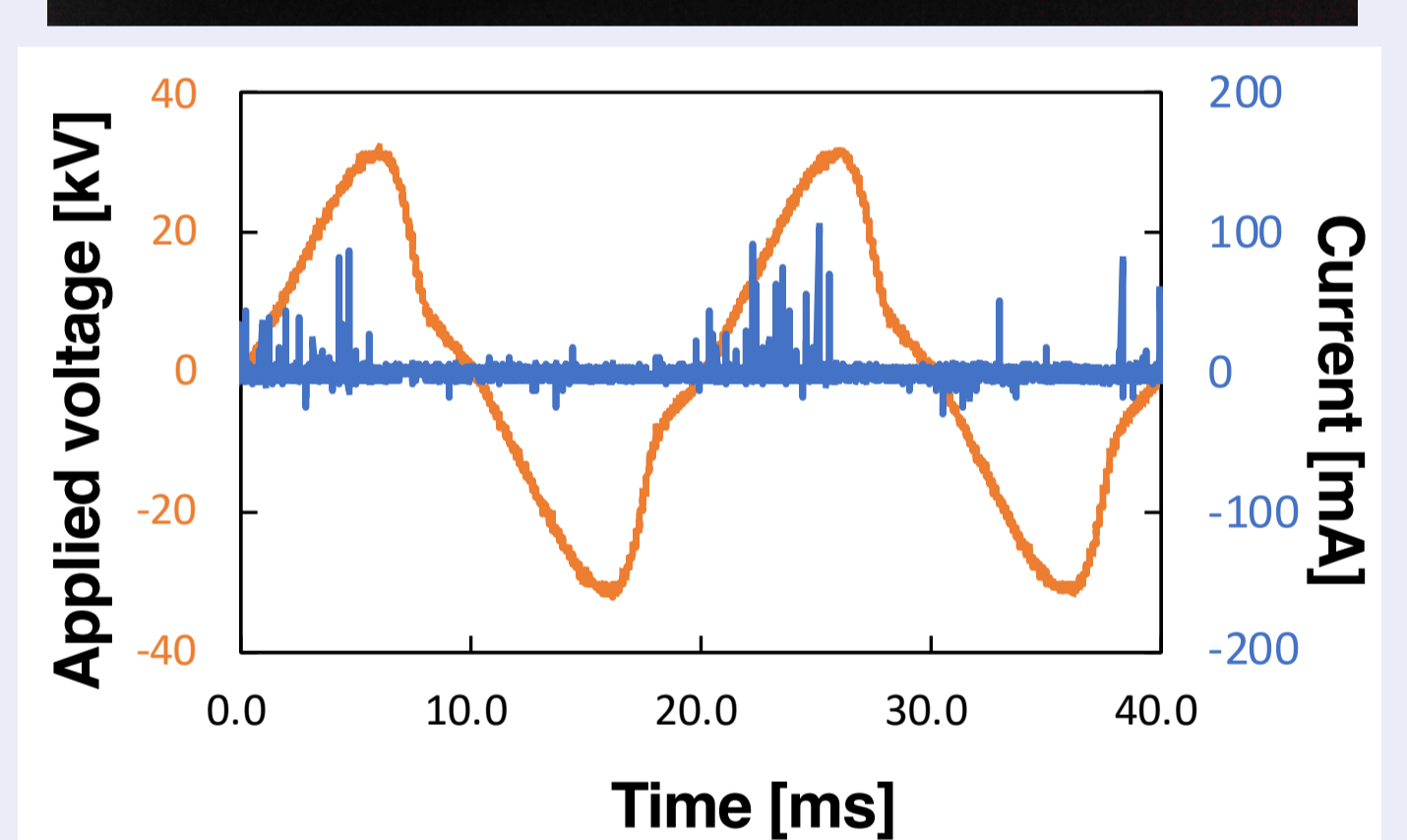
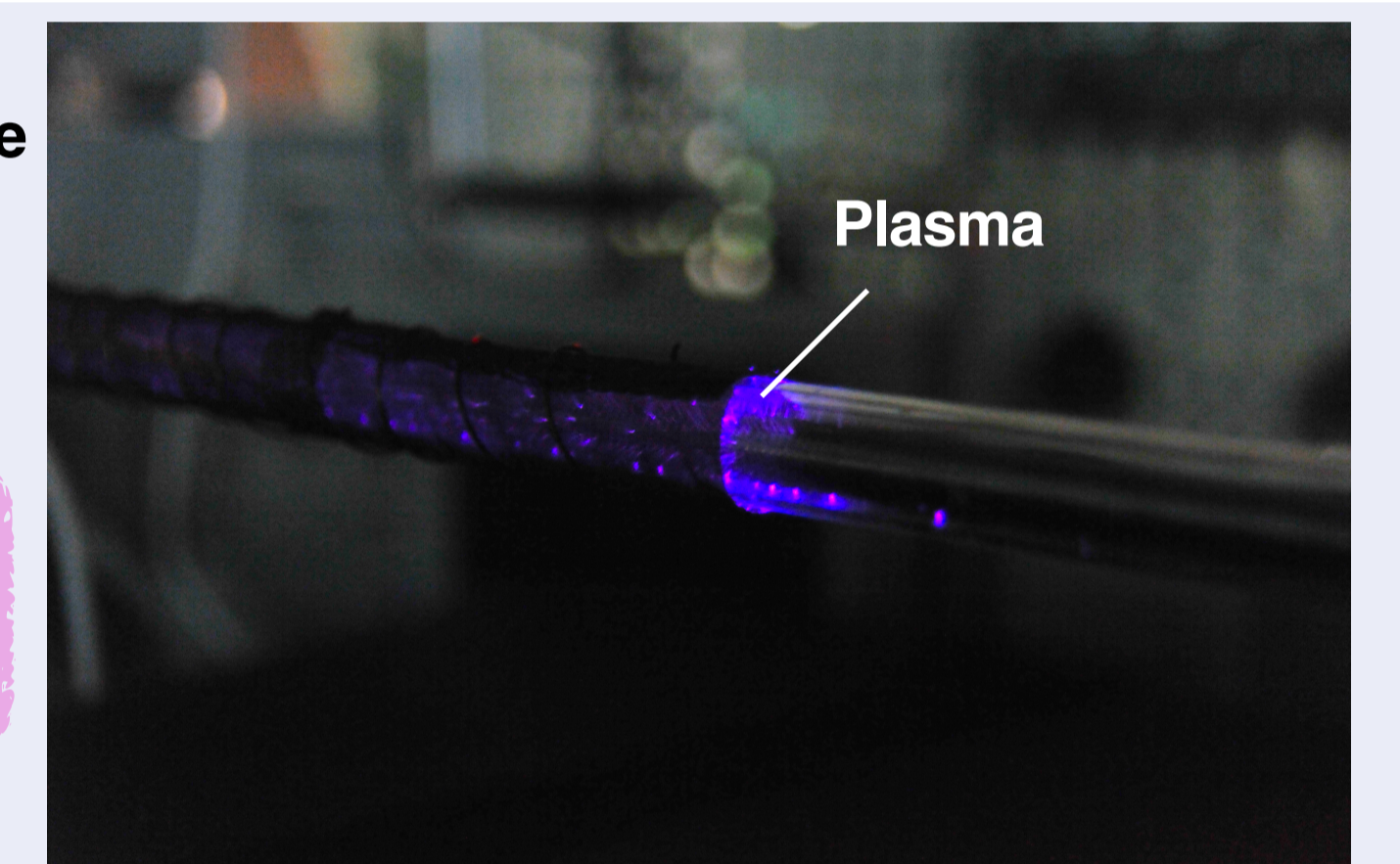
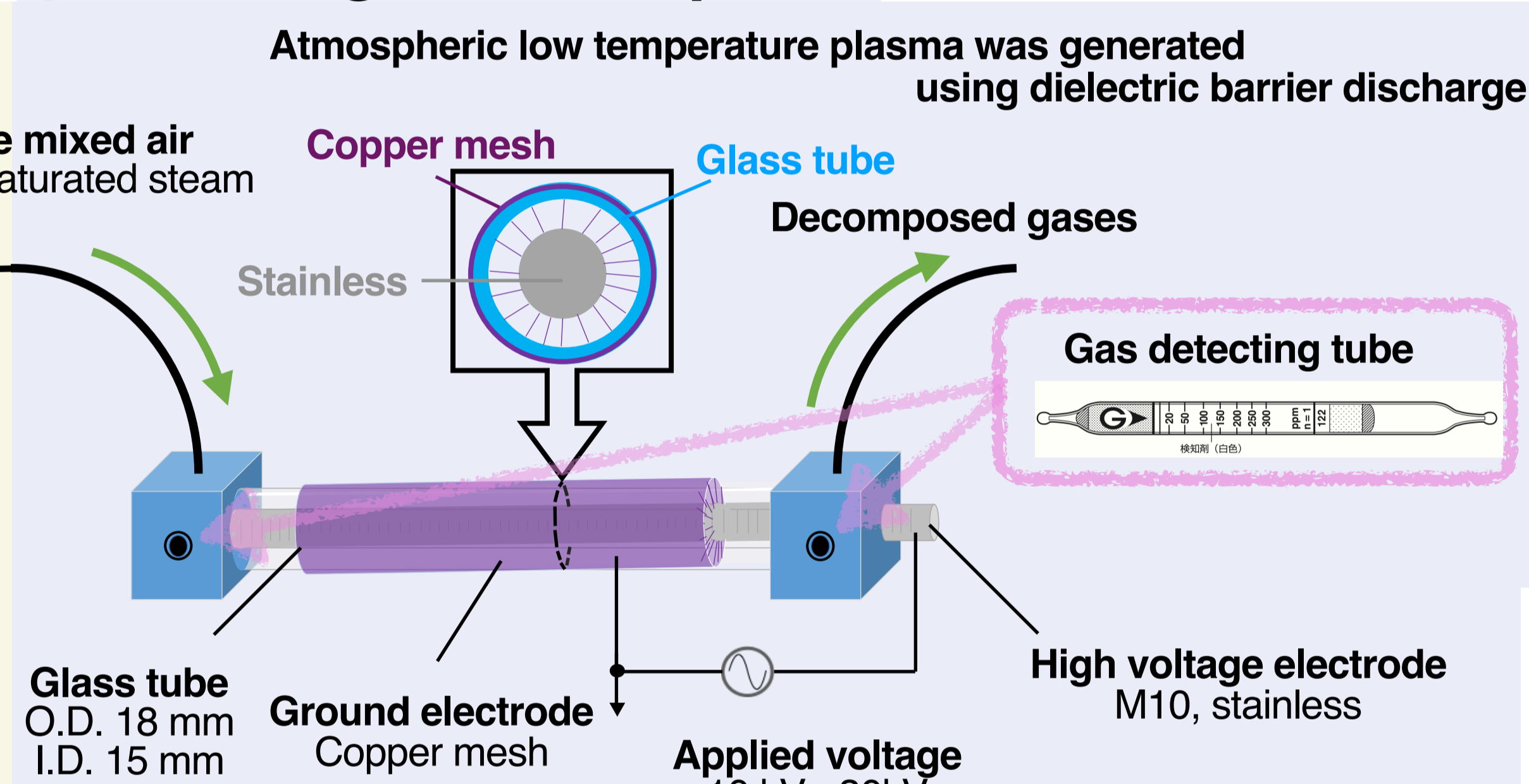
- Decomposition system using dielectric barrier discharge (DBD) was developed.
- The effects of toluene decomposition rate on discharge power and gas flow rate were investigated.

2. High flow rate VOC decomposition device using atmospheric plasma

Toluene introduction part



Plasma generation part



Advantage of the developed device

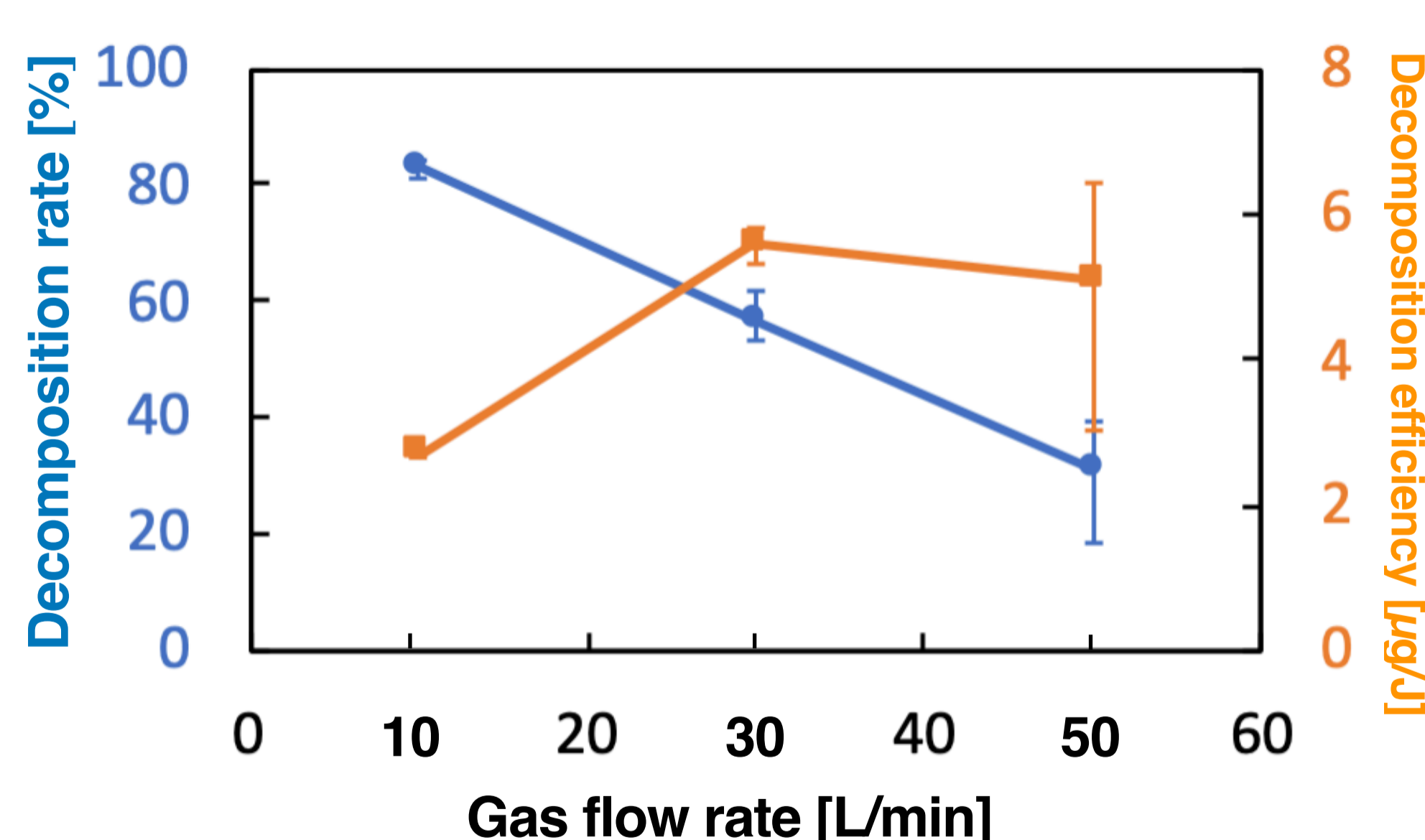
	Pellet-filled plasma device	Developed device
Gas flow rate	~ 1.0 [L/min]	~ 50 [L/min]
Components	Glass, electrode, dielectric	Glass, electrode

✓ Large volume can be flowed

✓ Simple structure

3. Results of toluene decomposition experiment

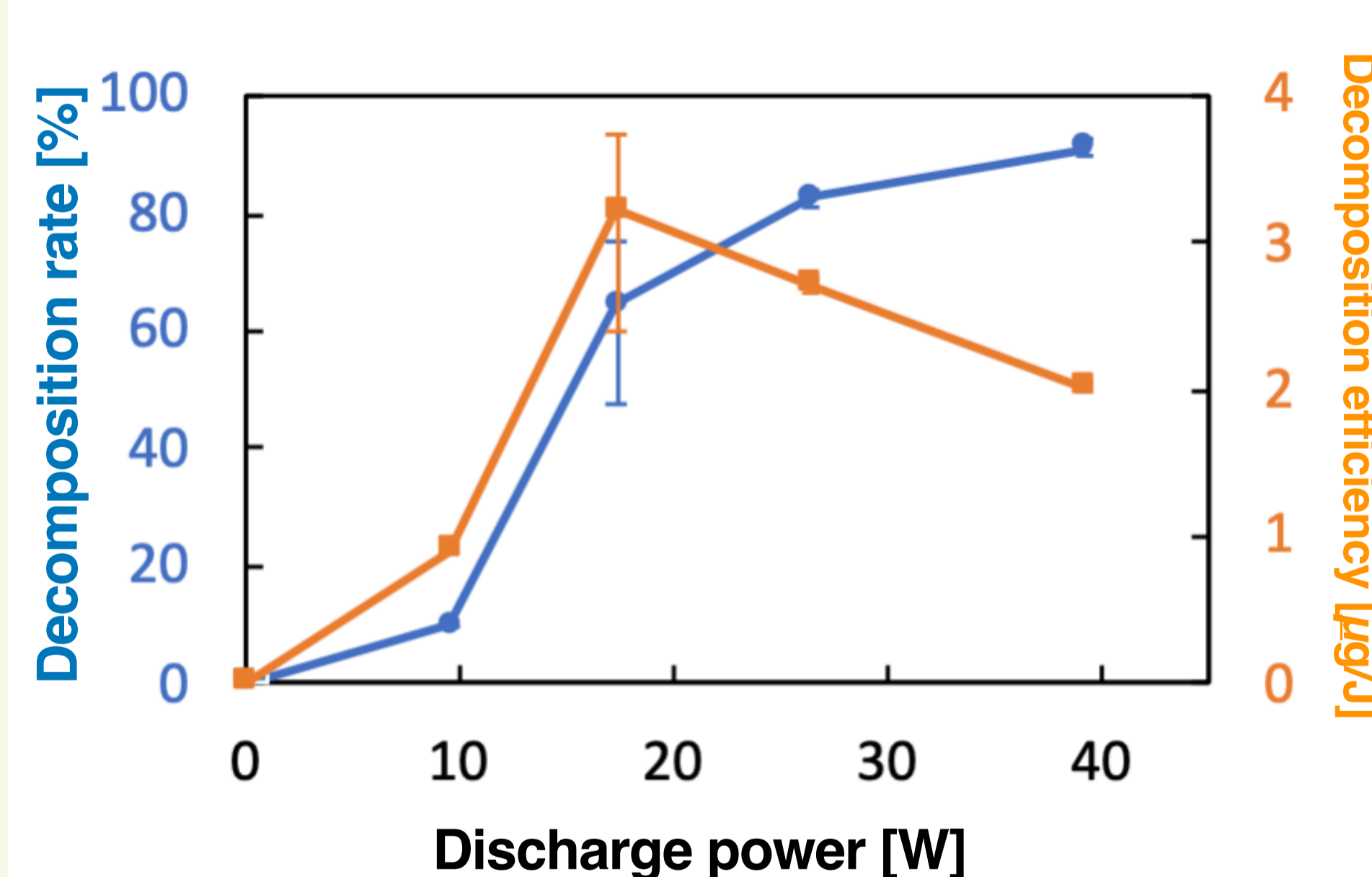
Gas flow rate dependence



Discharge power : 26 [W] Discharge length : 60 [cm]

✓ Decomposition rate decreased with gas flow rate.

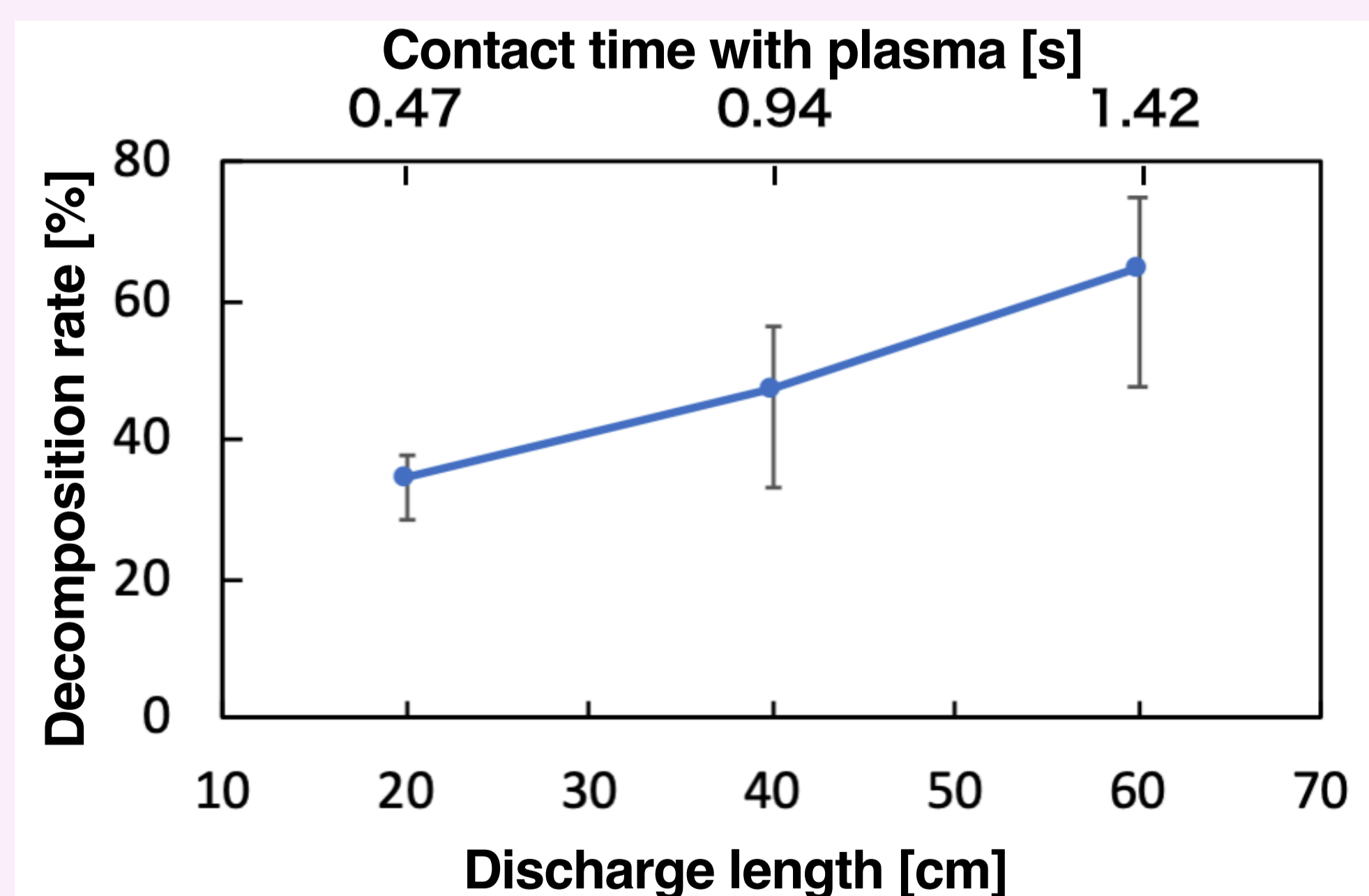
Discharge power dependence



Gas flow rate : 10 [L/min] Discharge length : 60 [cm]

✓ Decomposition rate increased with discharge power.

Discharge length dependence



Gas flow rate : 10 [L/min] Discharge power : 17 [W]

✓ Decomposition rate increased with discharge length.

➡ To decompose large volume of toluene, it is necessary to increase the **contact time with plasma** and **discharge power**.

4. Summary and Future plans

Summary

- ✓ Plasma decomposition device was developed.
- ✓ The decomposition rate of toluene improved with increasing discharge power and contact time with plasma.

Future plans

- The decomposition rate will be improved. (increasing discharge length etc...)
- The products after decomposition will be identified. (NO_x, CO₂ etc...)