

INFORMATION ON DOCTORAL THESIS

1. Full name: Lê Văn Luân
2. Sex: Male
3. Date of birth: 18/04/1977
4. Place of birth: Ha Noi
5. Admission decision number: 778/QĐ-CTSV Dated: Aug 21, 2017
6. Changes in academic process:
 - The PhD student extends the period of study for the 1st doctoral student (01 year) according to Decision No. 561/QĐ-DT dated August 28, 2020 of the Rector of the University of Technology.
 - The PhD student extends the period of study as a PhD student for the second time (01 year) according to Decision No. 803/QĐ-DT dated October 29, 2021 of the Rector of the University of Technology.
7. Official thesis title: Research and development of micropump systems intergrating mixing function using nozzle structre oriented to biomedical applications.
8. Major: Electronic Engineering9. Code: 9 51 03 02.01
10. Supervisors: Prof. Dr. Chu Duc Trinh
11. Summary of the new findings of the thesis:

Through the research methods applied in the thesis of “Research and development of micropump systems intergrating mixing function using nozzlestructre oriented to biomedical applications”, the thesis has achieved its intended purpose with the following key results:

- Suggested a micropump design with mixer function and the structure of new nozzle diffuser, integrated with capacitive sensors.
- Built a model that simulates the pumping and mixing functions of the device. The obtained data results have shown the impact of frequency, the voltage supplied to the PZT membrane on the flow, output pressure of the pump, and the mixing performance of the device.
- Created a micropump model that combines a mixer with the structure of a nozzle- diffuser using high-resolution 3D printing technology, integrated with capacitive sensors to determine the pumping environment and mixing ratio.

12. Practical applicability, if any:

Based on the results of research, simulation and practical experiments, the thesis has successfully manufactured a model of an infusion device oriented to be used in the medical industry. Although there are still some features and parameters that need to be further researched and perfected, the obtained results have confirmed the potential and contribution of the thesis for various practical applications in the biomedical field.

13. Further research directions, if any:

The research results are only initial successes, the thesis still has limitations that need to be further researched, developed and implemented in the coming time, specifically:

- Extensive research to further improve the performance of micropumps.
- Research and perfect the structure of the capacitive sensor and measuring system to be able to measure and quantify the solution concentration at the outlet of the pump channel.
- Expanding the study of the micropump structure according to the partial circulation feedback mechanism of the liquid flow at the output of the micropump so that the mixing concentration can be automatically adjusted as desired.

14. Thesis-related publications:

(1). Luan Le Van, Cuong Nguyen Nhu, An Nguyen Ngoc, Tung Bui Thanh, Van Dau Thanh and Trinh Chu Duc (2017), “A valveless micropump based on additive fabrication technology”, *The 6th International Workshop on Nanotechnology and Application - IWNA 2017, 08 -11 November 2017, Phan Thiet, Vietnam.*,627–630.

(2). Cuong Nguyen Nhu, Luan Le Van, An Nguyen Ngoc, Lam Dang Bao, Trinh Chu Duc, Van Thanh Dau, Tung Bui Thanh (2018), “Performance evaluation of a PZT actuated valveless mixer”, *The 22nd International Conference on Miniaturized Systems for Chemistry and Life Sciences November 11-15, 2018, Kaohsiung, Taiwan*, 682- 685.

(3). Cuong Nguyen Nhu, Luan Le Van, An Nguyen Ngoc, Van Thanh Dau, Tung Thanh Bui, Chu Duc Trinh (2018), “A valveless micropump based on additive fabrication technology”, *International Journal of Nanotechnology*, Vol.15 No.11/12, pp.1010 – 1023.

(4). Luan L Van, Cuong N Nguyen, Tuan T Nguyen, Thien X Dinh, Canh-Dung Tran, Lam B Dang, Tung T Bui, Van T Dau, Trinh D Chu (2019), “LIQUID PUMPING AND MIXING BY PZT SYNTHETIC JET”, *2019 20th International Conference on Solid-State Sensors, Actuators and Microsystems & Eurosensors XXXIII*, pp. 198-201 doi: 10.1109/TRANSDUCERS.2019.8808521.

(5). Luan Le Van, Tung Thanh Bui, Cuong Nguyen Nhu, An Nguyen Ngoc, Thien Xuan Dinh, Lam Bao Dang, Canh-Dung Tran, Trinh Chu Duc, Van Thanh Dau (2019), “Simulation and Experimental Study of a Synthetic Jet Valveless Pump”, *IEEE/ASME Transactions on Mechatronics*, vol. 25, no. 3, Doi: 10.1109/TMECH.2019.2960332.

(6). Cuong Nguyen Nhu, Luan Le Van, Lam Bao Dang, Van Thanh Dau, Tung Thanh Bui, Trinh Chu Duc(2021), “3D Printed Micro nozzle-based Mixer with Integrated Capacitive Sensor toward High Precision Mixing Applications”, *The 6th International Conference on Engineering Mechanics and Automation (ICEMA) 2021*.