

# New rotating liquid reactor design solves issues with current reactors

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Credit: Eindhoven University of Technology

Intensified reactors are used in a variety of chemical processes. One such reactor is the rotating packed bed (RPB) reactor which uses high centrifugal forces to accelerate chemical reactions between constituents.

However, the RPB reactor has a number of issues that affect its efficiency. With this in mind, for this Ph.D. research, Jasper Hacking designed a new reactor referred to as rotating liquid redistributor. Key to the new reactor is the inclusion of liquid-filled rings in the packing, which help to address several problems associated with traditional RPB reactors. Hacking defended his thesis on October 7th.

The rotating packed bed (RPB) reactor is a great example of a reactor that can improve the efficiency, expenditures and sustainability of chemical processes. A central issue though with the circular design of the RPB reactor is that it does not evenly distribute liquid chemicals (which depend on the process) in the reactor. This can lead to dry spots, which can negatively affect the efficiency of the chemical reactions in the reactor.

Another issue relates to the spraying of the liquid chemicals onto the packed bed using a nozzle. It has been shown that between 70% and 80% of the [mass transfer](#) takes place during spraying, and not in the packing as would be preferred.

## **New improved design**

In a new reactor design, Ph.D. researcher Jasper Hacking addressed these problems by ensuring that the liquid streams entering the reactor fall first on the packing, and from there are then redistributed throughout the reactor. This leads to an improvement in the efficiency. In addition, the absence of a nozzle design for spraying the packing means that the rotors can be stacked in the reactor, which in turn allows for a greater intensification of the process and helps the process to proceed more efficiently.

In a traditional RPB reactor there are not many options to adjust the packing. Each packing is designed for particular chemical process and

fixed to rotor. Unfortunately, this means that you need a different packing for any new reactor. For his reactor design, Hacking included a sort of basket that can contain different types of packings. As a result, this makes it easier to change the packing for use with a new [chemical](#) process.

## Heat transfer

Finally, the [heat](#) exchange capability of the RPB reactor is limited by the inability for heat to move inside the packing. Such a drawback is detrimental to the reactor as the central reactions take place in the packing and effective energy transfer is important for these reactions.

Hacking's rotating liquid redistributor does have the ability to transfer heat in the packing thanks to the combination of rings inside the packing and the addition of an external heat exchanger.

Results presented in the Hacking's thesis show that this new proof-of-principle reactor offers a good and effective alternative to the traditional RPB reactor. However, before the reactor could be used in existing processes, additional measures need to be taken with regards to the design. For example, it would be beneficial if the reactor could allow for a higher throughput of liquid and a better redistribution of the liquid in the reactor. This could be achieved by increasing the radius of the [reactor](#).

Provided by Eindhoven University of Technology

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