

TREATMENT OF RESIDUARY ACIDS BY MICROWAVES

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Many chemical syntheses take place in an acid medium (sulphuric or/ and nitric): the recovery of the final product requires a specific treatment of the reactional medium (separational or extractional ...) before the acid is reclaimed in the process.

In the case of nitro-glycerine (Ngl) synthesis, the treatment of the residuary acids, which come out of the synthesis workshop and contain 2,5 % of the final product, must be carried out with great care. In effect, the decant nitro-glycerine is then supernatant and may crystallise out, hence some risks of explosion.

The conventional method for the treatment of these acids consists in injecting water vapour (vapour temperature : between 130°C and 150°C) into the column fed at the foot with the solution to be treated.

The heat pick-up provokes a heating of the medium and triggers off the following reaction :

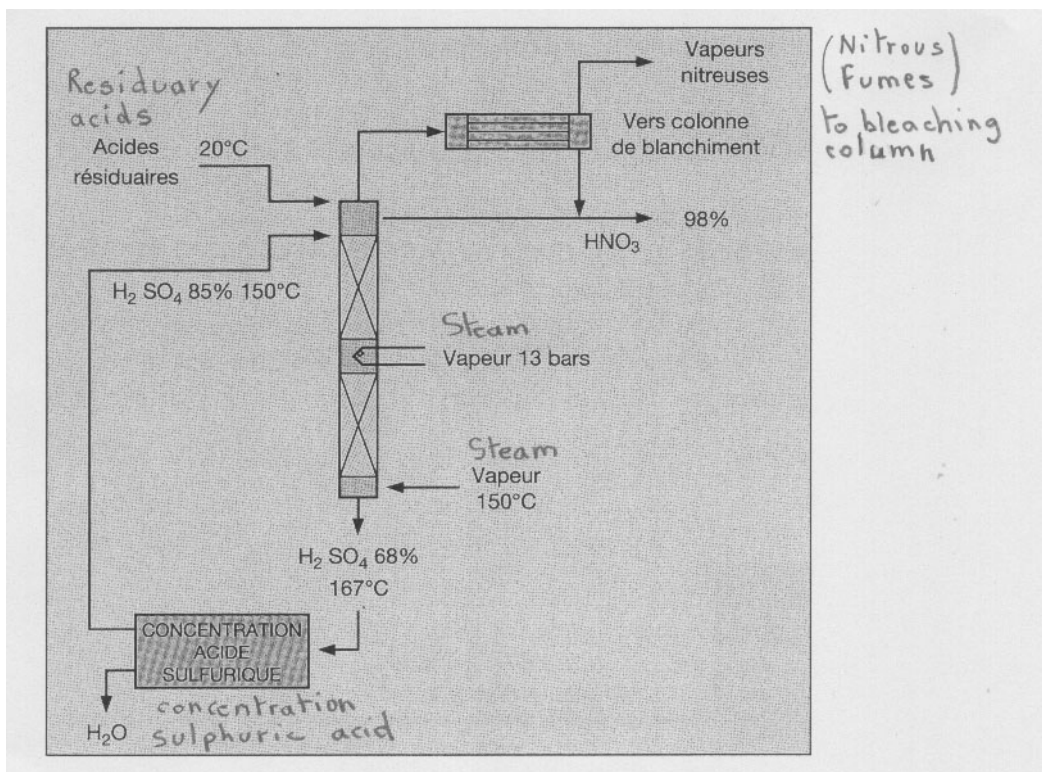
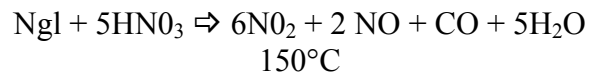


Figure 1. Diagram of the classical process.

This treatment presents many disadvantages:

- ♦ very long heating time (several hours) as very high temperature gradients have to be avoided
- ♦ little flexibility
- ♦ high treatment cost
- ♦ dilution of residuary acids, therefore a need for a reconcentration phase for the solution to be treated before it is reclaimed in the process.

The national company of powders and explosives (SNPE France Angoulême) is moving towards a new technology: microwave.

The SNPE has listed a new pilot for the treatment of acids. The tests results have brought to light the advantages of microwave.

The main asset of microwave is a heating without contact, hence no risk of corrosion. The other assets are:

- ♦ no dilution of the acid recovered
- ♦ a better expertise in the process (in the type of temperature)
- ♦ a lower power consumption in comparison with the traditional system.

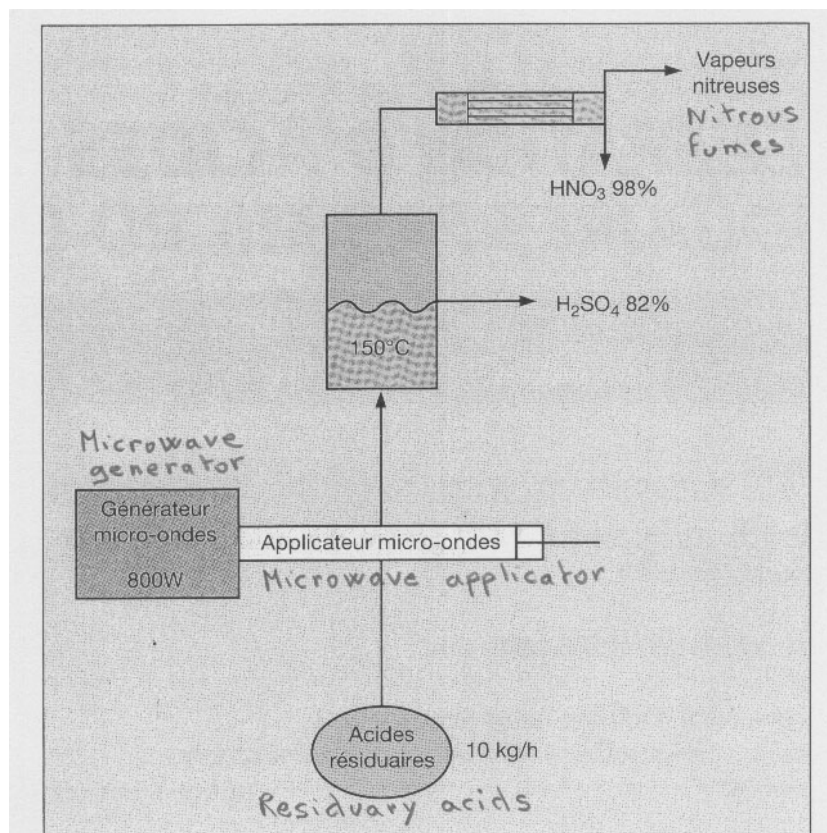


Figure 2. Diagram of the microwave process.

The SNPE has built up two industrial units (1 in France and 1 in Belgium). Each unit allows to treat 150 kg/ hour of residuary acids. The microwave power needed is equal to approximately 7.2 kg.

The acid is pre-heated at 65°C / 70°C. The pre-heating is carried out by a thermic exchanger which recovers the calories of the residuary acid treated by microwave (acids temperature : 120°C/ 130°C). This allows to save between 2 kW and 3 kW of microwave power.

Table 1. Comparison of the Investment Costs and the Running Costs.

TREATMENT	TRADITIONAL	MICROWAVE
INVESTMENT COST	808 000 Euros	795 000 Euros
RUNNING COST	8.08 Euros / ton of raw acid	3.81 Euros / ton of raw acid

For a load of 150 kg / h:

Energy prices 13.00 Euros / ton of vapour
 0.04 Euros / kW per hour

PROCESS

Mix

Glycerin + Sulfuric Acid + Nitric ACid

Creation Nitroglycerine + water (water remains with the sulfuric)

Sulfuric Acid

CONCLUSION

The treatment of residuary acids by microwave presents many advantages, essentially in case of effluents containing organic impurities which can be decomposed easily. This enables to cater for a double objective: on the one hand, this enables to reclaim some raw material in the process, and on the other hand, this enables to fight against environment pollution.