Analysis and improvement of the cashew nut shelling process

MADOUMIER M. (1), BASSAMA J. (2), COLLIGNAN A. (1), DIALLO M. (1,2), CHAPUIS A. (3)
1 Institut Agro Montpellier, UMR QualiSud, Montpellier, France
2 UniversitGaston Berger, Saint Louis, Senegal
3 CIRAD, UMR QualiSud, Montpellier, France

Cashew nut processing is a complex, poorly optimised and energy-intensive process. In Senegal, it is still largely carried out on an artisanal scale and more recently by small and medium-sized enterprises. The process starts with a long and tedious operation of shelling the nuts, which has a strong influence on the proportion of whole kernels obtained, and therefore the value of the product. Indeed, the yields of whole kernels after shelling observed are on average 50% and can at best reach 65% (Azam-Ali and Judge, 2001). Three pre-treatments (water immersion, steaming and air drying) are usually applied alone or in combination to facilitate shelling. Therefore, the objective of this study was to investigate the impact of these pre-treatments. For this purpose, an experimental study was conducted to identify the importance of each step and the control factors of the process. The shelling quality was evaluated by assessing the hardness of the shell (breaking strength) and quantifying the yield of whole kernels as well as the speed of shelling.
The study shows that the 3 pre-treatment unit operations when combined, weaken the nut and facilitate shelling. The control factors identified for these pre-treatments identified and their range of variation are the moisture content of the nuts from water immersion (7.68 - 20 % d.b.), the duration of steam treatment at 100°C (30 - 60 min) and the temperature of the drying operation. A factorial design was used and showed that the water content related to immersion had the greatest impact on hulling quality, followed by steaming time and, to a lesser extent, drying temperature (30 - 60 °C). A water content of 20% (d.b.), a steaming time of 60 min and a drying time of 60°C for 9 hours weaken the nut at best (breaking force of 800 newtons) and allow to reach a whole kernel yield of 90% while maintaining a shelling rate of about 4 whole kernels/min, i.e. twice as high as what is observed in real production. Further studies are needed to better understand the mechanisms of nut embrittlement and optimize the whole process.