Study of sorghum grain pretreatments and milling for new functional flours and semolina

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Sorghum (Sorghum bicolor, L) is the 5th most cultivated cereal in the world for its grain. Sorghum is gluten-free and has interesting nutritional properties. In Europe, its cultivation is increasing rapidly, and has benefited from EU funds for its promotion throughout the continent in recent years [1]. Sorghum can provide farmers with diversification and an agronomic response to global warming due to its high photosynthetic and drought tolerance, its reduced and fertilizer requirements, and its resistance to pests [2]. With these agro-environmental qualities, sorghum grain could become an important component of global food security. The milling process is used to transform cereals, by combining different unitary milling operations and sorting of particles according to their size or aerodynamic properties. While this process has been widely optimized for wheat in order to separate the starchy albumen with low contamination of peripheral tissues and germ and produce flour or semolina in the case of durum wheat [3], this milling process has been scarcely studied for sorghum. The main challenge for sorghum is the location of the germ within the grain [4] that affects negatively the stability of flour. The aim of this study is to investigate the influence of pre-treatments (hydric, mechanical dehulling) to remove the peripheral envelopes; the different milling steps and settings associated with different granulometries to diversify the end products usages (semolina and flour). An experimental design was conducted considering these factors to optimize the extraction yield of flour/semolina and the quality of end product. Specific conditions combing pretreatments and milling conditions were identified to produce high extraction yields of semolina and flour. These conditions were tested for hard (white) and soft (red) sorghum varieties to better rely the impact of intrinsic physical and biochemical properties of grain on extraction yield, granulometry and functionality of end products. A focus was then made on germ distribution in the flour and its impact through accelerated aging experiments in controlled temperatures. Biochemical and spectroscopic (FTIR) analyses were used to better assess these changes. A link with the second transformation will be highlighted through some tests in bread and pasta production.