Summary

There is an increasing interest on natural pigments to replace some currently used synthetic dyes, since the latter have been associated with toxic effects in foods. The red pigment of the fungus *Monascus* is widely used in all the world as food additives or pharmaceuticals. Although pigment production by *Monascus* spp. in chemically defined media is well documented, very few information is available about the use of agro-industrial wastes.

In this regard, the present study has been devoted to investigate the effect of different parameters on red pigment production by the local isolated strain of *M. purpureus*, in an attempt to maximize the production, and also to develop a potential fermentation process for the production of red pigment using potato processing wastewater (PPW, waters used to wash the potato slices prior to cooking in chips and crisp manufacture) as cheap production medium.

The results can be summarized in the following points:

1- Out of 22 fungal isolates previously isolated from different sources, only 7 isolates showed the ability to produce red pigment in the broth medium, with *Monascus* isolate the most producer strain (0.31g/l).

2- The ethanolic extraction of this *Monascus* pigment showed a unique light absorption characteristic at 498nm, indicating red pigment.

3- The *Monascus* isolate was identified according to their morphological and cultural characteristics as *Monascus purpureus.*

4- The most promising medium for red pigment production by this strain was MPI medium, which contains glucose and ammonium chloride as carbon and nitrogen sources, respectively.

5- For improving red pigment production by *Monascus purpureus*, optimization of environmental and cultural fermentation conditions were carried out:

a- The incubation period of 4 days was the best period for red pigment production.

b- The maximum production of red pigment (0.33g/l) occurred at incubation temperature of 30 ºC and initial pH 5.5.

c- Red pigment production was increased by increasing agitation speed up to 150 rpm, at which the fungus produced 0.32g/l.

d- Starch was the best carbon source for red pigment production by this strain, and 20g/l of starch was the best concentration for the optimum pigment secretion (0.55g/l).

e- Supplementation of the production medium with ammonium sulfate (0.4g/l) as nitrogen source was superior for the production of red pigment (0.77g/l) by this fungus.

f- Addition of $CaCO_3$ (0.1%, w/v) to the modified MPI medium (which contains starch and ammonium sulfate as carbon and

nitrogen sources, respectively) increased the yield of red pigment production (0.91g/l).

g- The inoculum type, seed culture, at age 12 h and density 2% (v/v) gave significant increase in red pigment production (1.27g/l)

h- Also, the maximum red pigment concentration (1.28g/l) was obtained at 50 ml CMV/250 ml FV.

6- Exposuring the spore suspension of *M. purpureus* to different doses of gamma radiation showed the sensitivity of this fungus to gamma radiation with D_{10}-value of 0.54 kGy.

7- Furthermore, the results showed that low doses of gamma radiation from 0.25 to 1.0 kGy stimulate the red pigment production, and the highest pigment accumulation (1.9 g/l) was achieved at radiation dose of 0.50 kGy.

8- Immobilized irradiated spores (in sponge cubes) of *M. purpureus* (24 h age and 0.5g cubes/50 ml medium) produced high amount of red pigment reached up to 2.32g/l, after 4 days of incubation, compared with the amount of pigment produced by the free cells (1.84g/l).

9- Agro-industrial waste (PPW) was examined as the main culture medium for red pigment production by this fungus under optimizing culture conditions for repeated batches. The results showed that with irradiated immobilized cells, the maximum amount of red pigment production (1.96 g/l) was recorded at the second batch. Moreover, high reduction of

BOD (82.6%) for this waste was obtained during the second batch.

10- The ethanolic extraction of red pigment produced by this fungus had no antimicrobial activity.

11- For food and pharmaceutical applications the possible toxicity of the produced red pigment was investigated. The data revealed that very little amount of soluble toxic substances in the extracted sample leading to only 8% dead chicken embryos.