EFFECT OF GAMMA RADIATION ON SOME COMPONENTS OF WHEAT FLOUR

By:

RAOUF M.A. EL-SAADANY

B. Sc. (1958) Cairo Univ.

M. Sc. (1968) Ain Shams Univ.

THESIS

Submitted In Partial Fulfilment of

The Requirement For The

Ph. D. Degree

From

Food Science Department

Faculty of Agriculture

Ain Shams University

1972

TO WHOM THEY GAVE ME LIFE

TO

MY PARENTS

AND

MY FAMILY

This Thesis for the Ph.D. Degree

has been Approved by :

....

....

....

Date : / /1972

ACKNOWLEDGEMENT

The author is very much indebted to Prof. Dr. Y. H. Foda Professor of Food Sci., Faculty of Agric., Ain-Shams University, for his continuous supervision, writing and discussion as well as his valuable assistance throughout this research.

He also thanks Dr. M. A. Abdallah lecturer at Food Sci. Dept. at the same Faculty of Agric., for his brotherhood helpfulness and his guidance throughout this investigation.

The author gratefully acknowledges all the staff members of the Food Science Department, Faculty of Agric., Ain-Shams University and the staff members of the Atomic Energy Establishment.

CONTENTS

Page

INTRODUCTION

Wheat is the most important grain crop in the world. Almost all wheat is made into flour which is converted to some products such as bread, cakes, macaroni and other pastries.

The cultivation of wheat extends upon large area in the world. The area grown by wheat grain is estimated by about 532 million acres which supplies the world production by this commodity. The largest wheat producing countries are the U.S.S.R., U.S.A., Canada, France and India. Wheat and flour are also the chief exports of the fore-mentioned countries as well as, Australia and Argentina, (Wilsie, 1962).

Egypt imports wheat flour as its local production does not satisfy its needs as shown in Table (A).

In spite of the great progress in cereal technology large amounts of grains and flour are still lost owing to deterioration and damage occurring during production and storage. The world losses of grains amounted to about 5 % of the harvested quantity (Kent Jones and Amos, 1967).

These losses may be due to insect damage, molds

Table (A): Local production of wheat in A.R.E. as well as the imported quantity and its price.

Year	Area of wheat by 1000 feddans	Local production of wheat by 1000 metric tons	Imported amount of wheat by 1000 metric tons	Price of imported amount by 1000 pounds
1960	1352	1499	1281	20199
1961	1339	1436	1258	20007
1962	1455	1593	1568	24770
1963	1345	1493	2102	32210
1964	1295	1500	1996	31358
1965	1145	1269	2371	37001
1966	1291	1465	2894	49972
1967	1245	1291	4449	56930
1968	1413	1518	2106	33430
1969	1246	1269	—	-
1970	1304	1516	—	-

After the year book of the Central Organization of Data and Statistical Information (1970).

and rodents. In addition these factors bring about undesirable changes in the quality and baking properties of the products.

Keeping the flour quality is considered to be one of the main goals of this study.

The health and welfare of mankind are intimately interwoven in a fabric called the economics of food distribution. The peaceful applications of atomic energy in the disinfection and stabilization of man's food are directly invelve in the economics of food distribution.

The use of ionizing radiation for keeping quality of foods is one of the important peaceful application of nuclear energy. This method has the advantages over other techniques that it can be used at ordinary temperature, as well as the food can be packed in the final state and it can be easily combined with any other method of preservation.

In spite of these advantages the radiation technique had been met with some distrust due to the possible induction of radioactivity and the formation of toxic compounds. At present it has proved without any dout that no such hazard can occur, (Morgan, 1958).

The U.S. Army quartermaster corps had made radiation preservation an accepted and authorized method. It is expected that in the near future even more products will be released.

The food industry has shown great interest in radiation techniques, but still more fundamental researches within this field are necessary to be acheived. It seems necessary to study the chemical and physical changes occuring in the food properties after exposure to the doses of gamma rays. The study as well should be continued during storage.

AIM OF INVESTIGATION

This study was undertaken in cooperation with the Atomic Energy Establishment and the General Milling Establishment, to study the effect of gamma rays on the chemical and physical properties of wheat flour as well as the keeping quality of flour during storage. The main points of interest with respect to physical properties are, intrinsic viscosity, dough properties by Farinograph and Extensograph, as well as using the Amylograph for calculating the flour viscosity.

With regard to chemical properties of flour that changed due to radiation, it was taken into consideration to study protein grouping by electrophoresis, and the Biuret test. However, oxidation of starch and its branching were also studied to find out the effect of radiation on these properties.

Using irradiated flour for bread making was also one of the interesting aims of this work, to reveal the effect of irradiation of flour on the properties of dough and the produced bread.

REVIEW OF LITERATURE

Discovery of radioactivity.

It was at 1896, when Henri Becqueral, had discovered radioactivity, (Desrosier, 1963). He noticed that from several uranium salts an invisible radiation was emmitted. That radiation was able to traverse thin layers of opaque materials and affects a photographic plate. The artificially produced radiation that were named X rays, were also reported in 1896 by Roentgen who gave a complete and accurate discription of their properties, (Tolansky, 1961). This discovery served as a stimulus for workers to observe the properties of radiation emmitted by uranium compounds and other natural materials.

In 1898, Schmidt and the Curies, independently noticed that similar radiation was produced by compounds of thorium, (Tolansky, 1961). At the same time, the Curies isolated from uranium salts a new element called radium.

It was shown by many scientists that the radiation of uranium compounds could be deflected and partially resolved under the influence of strong magnetic fields, as

mentioned by Desrosier (1963). The portion not affected by the magnetic field was observed to be capable of traversing thick layers of matter. The entire undeflected part was at first termed "alpha" (α) radiation, whereas, the deflected parts of the radiation that behaved like electrons was termed "beta" (β) radiation. In 1903, Rutherford, demonstrated that if the applied magnetic field was strong enough, the "alpha" radiation itself could be deflected and showed a distinctive positive charge. At the same time, however, it was found that a portion of the "alpha" radiation was highly penetrating and was undeflected even in the strongest magnetic field. The component was termed "gamma" (γ) radiation and was found to be similar to X-rays , (Desrosier, 1960).

Source of radiation .

One of the many factors involved in the development of suitable radiation techniques is the selection of the type of radiation to be employed. The food industry has been mostly interested in the use of ionizing radiation as a potential method for preservation of foods. Ionizing radiation can be delivered in the form of gamma rays, X-rays or electron form, from a variety of different sources .

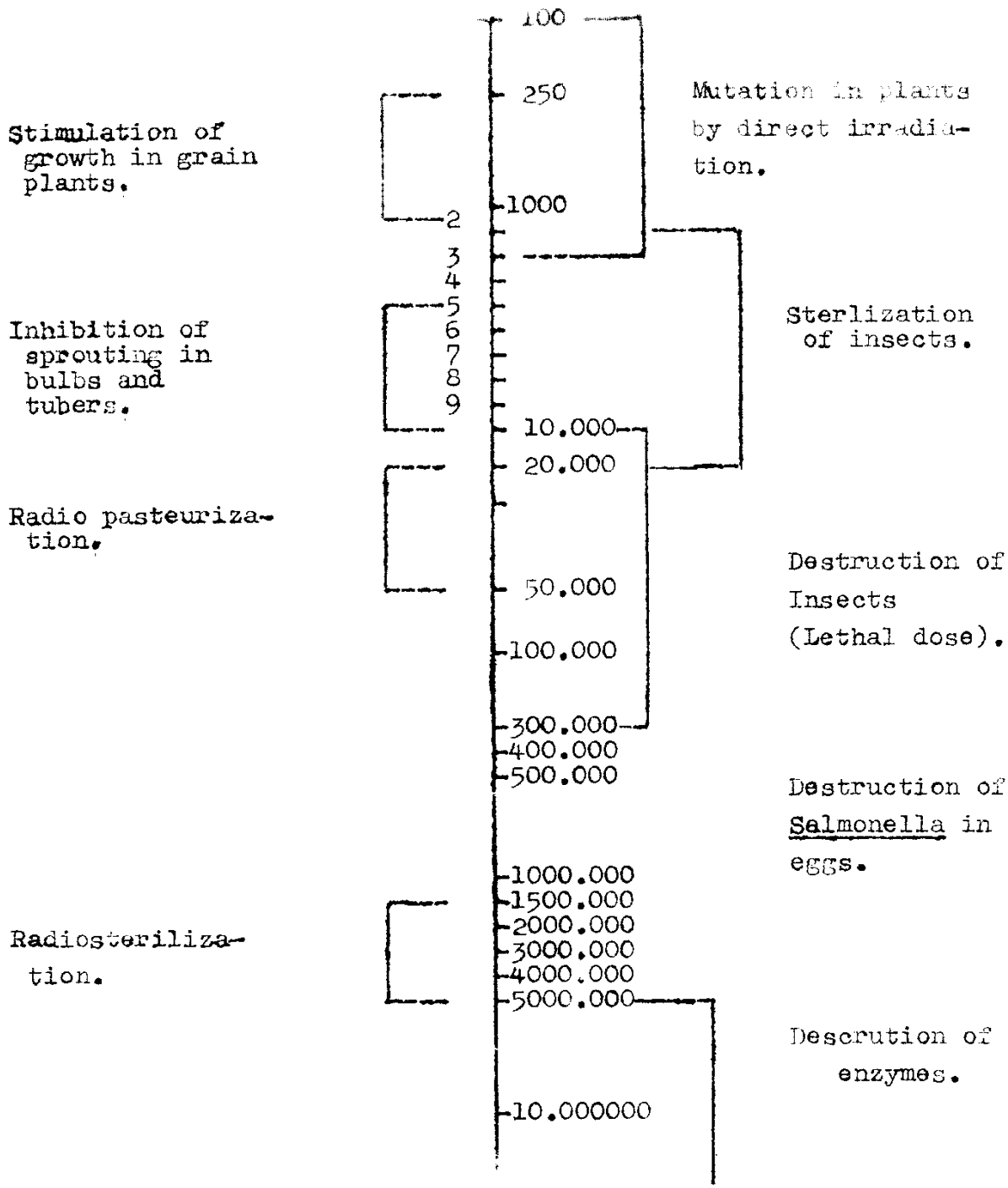

Fig.(1): Effect of radiation as function of dose (rad) (After Solanas and Darder, 1968).