جـــامعة الفـــيوم
Fayoum University

Name of Candidate: Yara Abdel Gawad Abdel Ghany
Degree: MASTER OF SCIENCE
Title of Thesis: THE EFFECT OF ADDITIVES AND GAMMA RADIATION ON THE PHYSICAL AND MECHANICAL PROPERTIES OF NEW DEVELOPED CONCRETE
Supervisors: 1- Mostafa Mohsen Abdel Razek Radwan
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Department: Engineering Mathematics and Physics
ENGINEERING
Approval-: / / 2017

ABSTRACT

In recent years radiation can be a serious concern in nuclear power facilities, particle accelerator work, industrial or medical X-ray systems, radioisotope projects, and a number of other existing states of affairs. Gamma-rays are hazardous for living cells and tissues due to their ionizing nature. Shielding radiation and preventing it from causing such physical harm to employees or their surrounding environment is the essential requirements of operating equipment that emits potentially harmful radiations.

The most common materials are lead, iron, boron, concrete, and polyethylene. However, using the appropriate concrete is proven to have a lot of advantages compared to other materials. A large quantity of marble dust powder is generated during the cutting process or sawing and polishing of marble blocks so the reuse of this waste material is considered the main economic benefit as many environmental problems can be caused due to this waste generated from the industries. Incorporation of marble dust powder as a fine aggregate additive to the concrete has been investigated in this work for its effect on shielding properties from the nuclear energy.

Five concrete mixtures containing 0, 5, 10, 15 and 20% marble waste powder as cement replacement by weight basis have been prepared. Water/cement ratio (w/c) was varied with varying the marble concentration in the prepared mixtures. The chemical compositions of the five mixtures were estimated using X-rays Florescence (XRF) technique. A compressive strength test was performed for the prepared mixtures. Gamma ray transmission and the parameters which affect this process such as mass attenuation coefficients, the half-value layer (HVL) tenth value layer, relaxation length, effective atomic numbers and effective electron density at different photon energies were calculated theoretically by WinXcom program. The results were calculated at the famous three energy lines Co^{60}(1.173 MeV & 1.332 MeV) and Cs^{137}(0.663 MeV). Also, an experimental study was performed in this work. A collimated beam of gamma-rays (^{60}Co) was used to study the gamma spectra behind the concrete specimens using Sodium iodide NaI(Tl) scintillation detector which communicates with the PC by Genie2000 software. Two methods are used for analyzing the results obtained from the radiation test and a comparison study between the theoretical results and the experimental ones were done.

The summary not more than 500 words

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The results show that, increasing the marble content in the mixture leads to an increase in the compressive strength. The experimental values of mass attenuation coefficients, effective atomic numbers and effective electron densities are in good agreement to some extent with the theoretical values. The values of attenuation parameters of the concrete mixtures have been found to be decreased with the increase in gamma ray photon energy and among the investigated samples; the concrete samples which contains 5% and 10% marble are good candidates for gamma ray shielding.

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