



# Conservation of bibliographic collections using gamma ionization – paradigm for cultural collections professionals

Brito<sup>a\*</sup>, S. G.; Oliveira<sup>b</sup>, M. J. A.; Salvador<sup>c</sup>, P. A. V.

<sup>a, b, c</sup> Institute for Energy and Nuclear Research, 05508-000, São Paulo, SP, Brazil.

\*Correspondence: [susyleide@yahoo.com.br](mailto:susyleide@yahoo.com.br)

**Abstract:** The preservation of cultural assets, especially bibliographic collections, requires the dissemination of the gamma ionization technique, which is mainly used for the decontamination and sterilization of these materials. The procedure, which is used to preserve library collections in Brazil and other countries, is also used to preserve documents and art collections, being safe to handle, after ionization, once it leaves no residue behind. The aim of the study was to assess knowledge and identify behavioral aspects related to gamma ionization and its application in decontaminating collections. The target audience was a group of professionals who work with cultural assets in Pernambuco and other states. Two questionnaires were used, obtaining 39 and 105 respondents respectively, characterizing the participants and their knowledge of gamma ionization. The research was qualitative and quantitative, of a phenomenological nature. For the analysis, questions were grouped into thematic blocks, characterizing the participants, finding out “knowledge of gamma ionization itself” – with both knowledge and ignorance of the concept and application of the technique – and also collecting from participants their feelings, opinions and positions on various aspects of the application of gamma ionization. Finally, means and personal sources of obtaining information were specified, dealing with sharing of information.

**Keywords:** Gamma ionization. Decontamination. Documents. Cultural assets.



# Conservación de colecciones bibliográficas mediante ionización gamma – paradigma para los profesionales de las colecciones culturales

**Resumen:** La preservación de los bienes culturales, especialmente de las colecciones bibliográficas, requiere de la difusión de la técnica de ionización gamma, que se utiliza principalmente para la descontaminación y esterilización de estos materiales. El procedimiento, que se utiliza para preservar colecciones de bibliotecas en Brasil y otros países, también se utiliza para preservar documentos y colecciones de arte, siendo seguro de manipular, después de la ionización, una vez que no deja residuos. El objetivo del estudio fue evaluar el conocimiento e identificar aspectos de comportamiento relacionados con la ionización gamma y su aplicación en la descontaminación de colecciones. El público objetivo fue un grupo de profesionales que trabajan con bienes culturales en Pernambuco y otros estados. Se utilizaron dos cuestionarios, obteniendo 39 y 105 encuestados respectivamente, caracterizando a los participantes y sus conocimientos sobre ionización gamma. La investigación fue cualitativa y cuantitativa, de carácter fenomenológico. Para el análisis, las preguntas se agruparon en bloques temáticos, caracterizando a los participantes, averiguando “conocimientos de la ionización gamma en sí” – tanto con conocimiento como desconocimiento del concepto y aplicación de la técnica – y recogiendo también de los participantes y sus sentimientos, opiniones y posiciones, sobre diversos aspectos de la aplicación de la ionización gamma. Finalmente, se especificaron los medios y fuentes personales de obtención de información, en lo que respecta al intercambio de información.

**Palabras clave:** Ionización gamma. Descontaminación. Documentos. Bienes culturales.

## 1. INTRODUCTION

Ionizing radiation technology can be comprised in  $\gamma$  rays and particle beams, as well. Radiation processing has been conventionally applied to various types of materials, such as cultural goods, disposable medical products, foods, polymers, etc., to sterilize, disinfect, inactivate viruses or modify physical properties of these materials. The procedure is carried out in commercial or research irradiators, using cobalt-60 or an electron beam. A relevant characteristic is: materials, after being irradiated, do not become radioactive and can be manipulated immediately after the process.

Regardless of the age of a collection of tangible organic material, the application of radiation technology/gamma ionization is completely feasible. It is emphasized that, according to different studies, positive results can be achieved with the use of  $\gamma$  rays for the conservation of library or archive materials [1].

Fungi and insects are constant concerns in libraries, archives and museums. These microorganisms are the target of studies that predict their elimination with exact doses of ionizing radiation, without the structure of the material being significantly altered. There is reported success with doses ranging between 2, 4, 6, 8 and 10 kGy in the treatment of disinfestation and disinfection [2].

The International Atomic Energy Agency (IAEA) has been promoting events for decades, aimed at the benefits that member countries can obtain through the irradiation of cultural goods [3]. At the same time, not only irradiated collections remain preserved, but the job quality of workers who handle the material is improved through such disinfection or disinfestation [4]. Gamma radiation technology has made important contributions to preservation, preventing old books, archival documents and other paper materials from

being damaged by mold, in addition to ensuring a good quality of life for employees and users of libraries and archives [4, 5].

The Institute for Energy and Nuclear Research – IPEN [6], brings the countless possibilities of the Multipurpose Irradiator, from the Radiation Technology Center (CETER/IPEN). The installation also promotes pioneering applications in Brazil, such as disinfestation and containment of the proliferation of microorganisms in cultural assets and works of art using  $^{60}\text{Co}$  ionizing radiation. Depending on the dose of radiation applied, the material can prevent organisms reproduction, ensuring eradication and the end of the organisms life cycle, or immediately sterilize the product with a higher dose, considering that side effects of that dose are not harmful. Brazilian institutions adopt the ionization procedure as a technique for bringing security to collections, preserving their healthy condition, without altering their qualities [7].

In European countries, there are examples of gamma irradiation applied to books available for public consultation. There is study carried out in the Netherlands, more specifically in 2003 at the Peace Palace Library, located in The Hague [8]. With emphasis on combating mold, harmful to health, present in the collections. “It is known that mold can cause allergic reactions, as well as heart problems and cancer. Measurements and investigations showed the presence of *Aspergillus*, *Cladosporium* and *Penicillium*” [8].

Comments are made on the responsibility of countries and institutions for the preservation of cultural heritage, especially libraries, museums and archive collections [9]. From this perspective, it is understood the importance of disseminating the application of the technique and reducing prejudices linked to its use, in terms of deconstructing versions without scientific foundations contrary to its application; in addition of investigating the level of knowledge of technology, by professionals responsible for conservation.

## 2. MATERIALS AND METHODS

Working materials were sought for the research, as well as the appropriate methodology, to study the behavioral aspect of collections professionals. In this sense, the data collection instrument was identified, as well as the method to be adopted for a study that focuses on the perceptions and knowledge of a target audience.

### 2.1. Materials

The research universe was formed by two distinct groups. The first group was made up of 39 people who work with rare and special collections from the Library System of the Federal University of Pernambuco, comprising library coordinators, librarians from the special collections and cataloging sectors, scholarship holders and interns from the Librarianship course.

The second group was formed by 105 people who work with various collections and cultural assets, comprising archivists, administrative assistants/technicians, librarians, curators, institution/company managers, historians, museologists, restorers and other professionals. This group includes the five country regions, including also the state of Pernambuco.

All research participants were contacted via email or social media groups. These professionals and students belong to libraries, public archives, museums, restoration workshops, judicial system units, public and private universities, as well as self-employed professionals.

### 2.2 Methodology

Before sending the questionnaires, a pre-test was addressed to ten people, to validate the data collection instruments [10]. The preparation of the questionnaires was based on this opinion research approach [11].

Data collection consisted of the application of two questionnaires to identify the level of knowledge of professionals in the area of preservation and conservation of collections and cultural assets about gamma ionization. Closed questions applied are attached herein.

The collection instruments were composed of objective (closed) and discursive (open) questions. The Likert scale, with five gradations, was used in most objective alternatives, with the purpose of collecting attitudes and opinions. With this scale, the participant can choose, among the alternatives, the one that best represents his assessment [12]. The Google Forms tool was used to collect data [13].

The questionnaire for the first group consisted of 19 questions, 18 of which were closed and one open. The instrument for the second group was composed of 20 objective questions. The study captures reality through the individual's own experience. Therefore, the phenomenological method proved to be more suitable for developing the research. The phenomenon is every manifestation understood by consciousness; this manifestation becomes, as in any method, important for understanding the object studied. The used method focuses on phenomena in the belief that essential truths about reality are based on lived experience [14]. It is vital to understand the subject's view of the object to seek the truth (*cogitatio*) in this relationship [15].

The experience of professionals and students in the area of preservation made possible to capture the perception of these individuals based on the manifestation of their consciousness. In this way, it is possible to infer from the answers to the questionnaires how much they know about gamma ionization for decontaminating collections. It is necessary, however, to highlight some limits of data collection through questionnaire(s), such as the suspension of judgment, prejudices, beliefs, fraud; so that the analysis is closer to the perceptions of the researcher [15].

Thus, we sought to analyze and compare the answers given by each participant to understand their position on the application of gamma ionization in accordance with the

literature studied. In terms of executing the study schedule, the questionnaires were prepared, applied and the data were subsequently compiled. Quantitative and qualitative approaches were utilized [16].

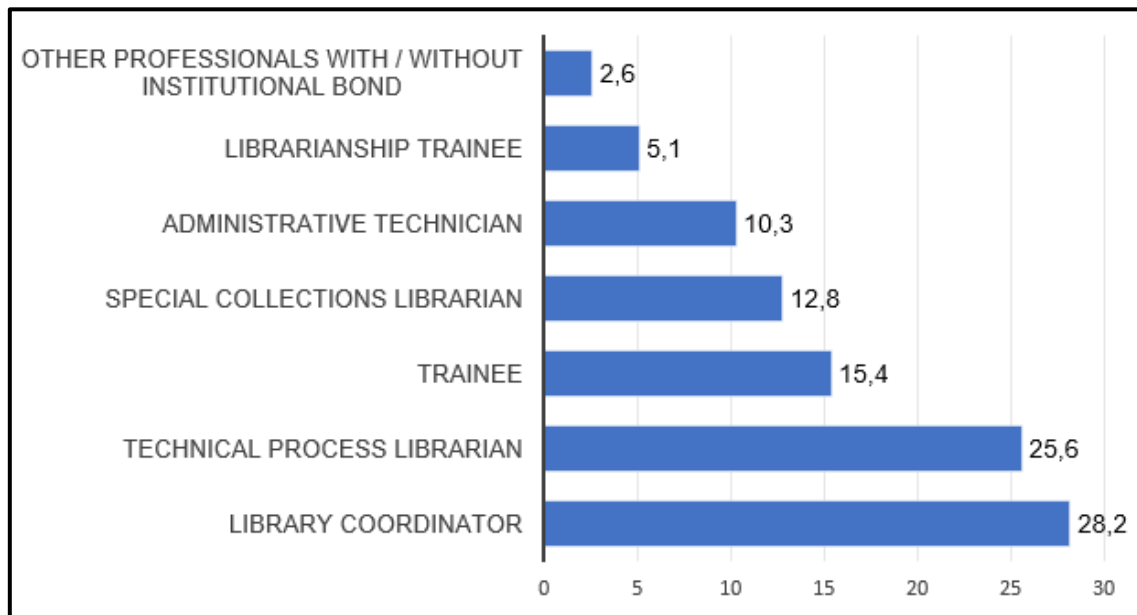
### 3. RESULTS AND DISCUSSIONS

The interpretation of data collected through opinion research presents figures, regarding the perception of the use of gamma ionization technology for decontaminating cultural assets. The information was collected from professionals from Intergrated Libraries System/Federal University of Pernambuco (SIB/UFPE), the first group, and professionals from the areas of conservation of cultural assets, in the second group. It is observed that the research had, as significant parameters: professional performance, geographic location and knowledge about gamma ionization. Most of the interviewees are librarians with postgraduate degrees.

#### 3.1. Presentation of respondents

Figures 1 and 2 present the characterization of the survey respondents. Figure 1 demonstrates the universe of participants in the first group, which is made up of coordinating librarians, from the technical processes and special collections sectors, scholarship holders, librarianship interns, administrative technicians and other professionals. This group was represented by thirty-nine people. In this first group, eleven of the librarians are library coordinators (28.2%). These professionals, acting as managers, have an important role in the knowledge and dissemination of the ionization technique.

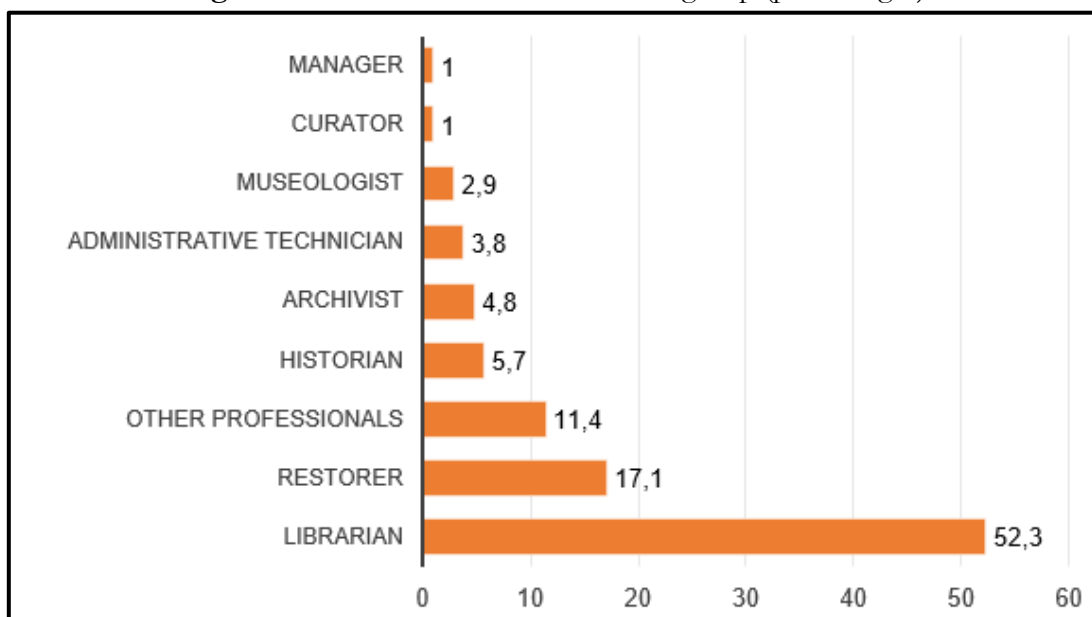
**Figure 1** – Office or function – first group



Source: authors.

Figure 2 shows the composition of the second group: there were a total of 105 respondents, including archivists, assistants, administrative assistants/technicians, librarians, curators, institution/company managers, historians, museologists, restorers and other professionals.

**Figure 2** – Office or function – second group (percentages)



Source: authors.



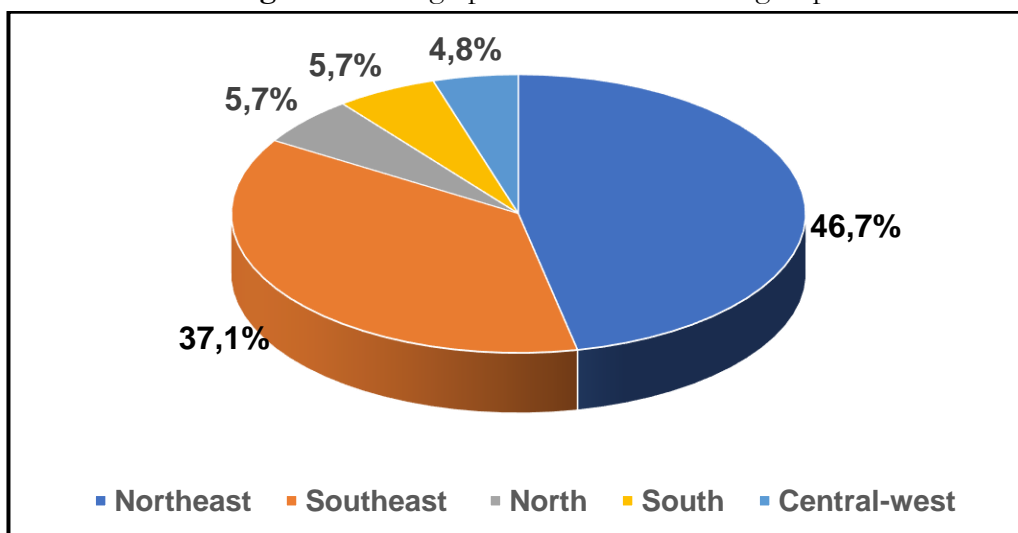
Federal, state and municipal public institutions are employers of professionals who perform the functions of preservers, recoverers and disseminators of information, recorded in different types of informational supports, who work on collections of cultural assets. This should justify the predominance among research participants in the two groups of civil servants and librarians.

### 3.2. Regionalization of interviewees

The research participants in the second group work in the five Brazilian regions presented in figure 3. The majority of participants are in two regions, the Northeast (46.7%) and the Southeast (37.1%), which total 83.8%. In third place (5.7%): the North and the South. The Central-West occupied fourth position (4.8%).

The study covered 34 Brazilian cities. Of these, 29 were identified by the respondents, while five of these only informing the state. Mostly, they work in the capital São Paulo (25.7%) and in Recife (18.1%), which make up 43.8%. The cities of João Pessoa (4.8%), Campina Grande (5.7%) and Natal (6.7%) were those with the most participants, in sequence.

**Figure 3** – Geographic location – second group



Source: authors.

### 3.3. Knowledge about gamma ionization or ionizing radiation

Once the research was carried out in terms of characterization and regionalization of the sample universe, the knowledge of the technique itself was surveyed, as well as its possibility of practical application.

The innovation of treatment methods, as well as the improvement of the performance of techniques, must be a continuous and active task in conservation and preservation science [17]. Gamma ionization is applied in various regions of the world to disinfect and disinfect library and archive collections [18]. In the literature, there are other studies that indicate the application of ionization for preventive and curative treatment [7, 9, 19].

Table 1 shows the questions “Concept of GI” and “GI application in collections”. The research participants have in common knowledge of the concept of gamma ionization.

**Table 1** – Knowledge of the concept and application of gammaionization in collections – first and second groups

Knowledge levels	1° group						2° group					
	GI concept			GI application			GI concept			GI application		
	S(%)	%	C	S(%)	%	C	S(%)	%	C	S(%)	%	C
I know a lot		0	--		0	--		10,5	5°		16,2	4°
I know	43,6	5,1	3°	35,8	17,9	3°	50,5	18,1	4°	54,3	18,1	3°
I know very well		38,5	1°		17,9	3°		21,9	2°		20	2°
Partially unknown	56,4	17,9	2°	64,2	23,2	2°	49,5	19	3°	45,7	16,2	4°
I totally do not know		38,5	1°		41	1°		30,5	1°		29,5	1°

Source: authors. Legend: GI = gamma ionization. S = sum. C = classification.

It is observed that the second group has greater knowledge of the concept of gamma ionization, with around 60%, while the first group has around 50%. Considering

professionals with complete lack of knowledge, there is a need for information in both groups; in the first (38.5%) and in the second (30.5%).

The second group also presented greater knowledge of the concept of the application of gamma ionization in the decontamination of collections in relation to the first group, suggesting that the public in the second group has more understanding of the technique itself, within the context of its application in the decontamination of collections, while the public in the first group understands gamma radiation outside the context of collection decontamination. Consistently, those who consider themselves to be completely unaware of gamma radiation do so both in the general context and in the context of decontaminating collections.

### **3.4 Participants' position regarding satisfaction, importance and recommendation of the technique**

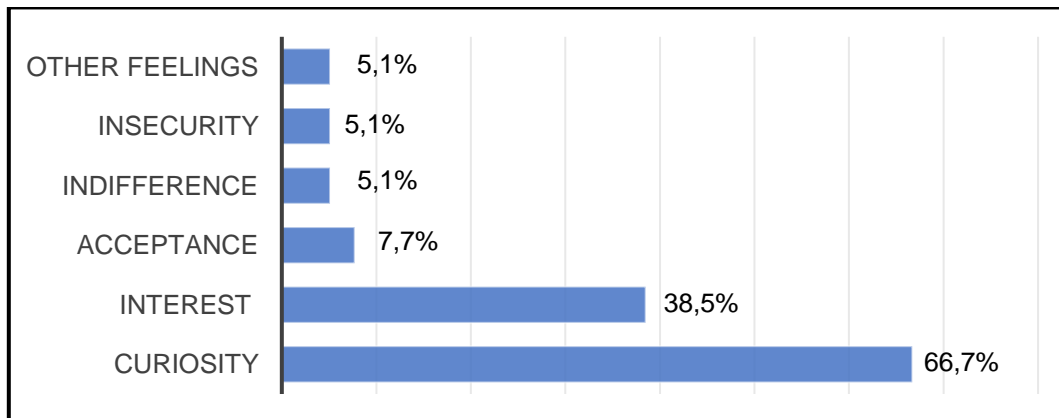
Regarding the positioning of professionals on the technique, perceptions were collected concerning to gamma ionization in the decontamination of collections; whether in terms of feelings, satisfaction, the importance of having knowledge about GI, safety, recommendation and, finally, the appreciation of the technique among respondents. High levels of interest and importance of information can be noted in both groups.

It should be stated that people are active and passive individuals in their social relationships and, in this way, active in their history with the acquisition of the ability to interpret and act. Authors highlight the participation of people, acting as influencers of their reality and thus allowing greater exchange of information [20].

Research participants were encouraged to demonstrate their feelings regarding the expressions “gamma ionization” and “ionizing radiation”, to understand the possible reasons for their stance on the option of using gamma ionization in the decontamination of collections. At this point, respondents had the option of choosing more than one alternative.

Figure 4 presents the feelings highlighted by participants in the first group. The “curiosity” alternative reached first place, with 66.7%, the “interest” alternative reached second place, with 38.5%. While the alternative “acceptance” obtained 7.7% of the choices. The other alternatives (indifference, insecurity and other feelings) reached the same rate: 5.1%. It is interesting to consider that the positive items were those most mentioned by the first group.

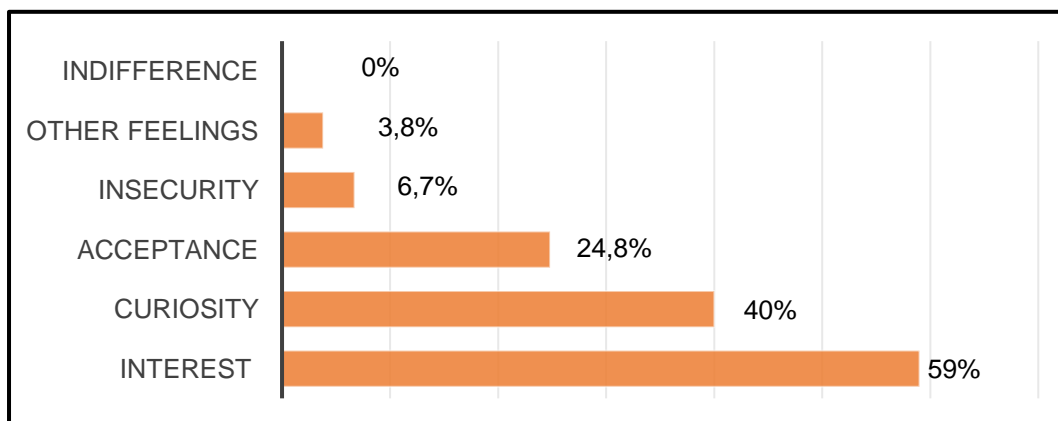
**Figure 4** – Feelings aroused by the expression gamma ionization – first group



Source: authors.

The feelings that the “expression gamma ionization in the decontamination of collections” aroused in the participants of the second group were, in this order: interest (59%), curiosity (40%), acceptance (24.8%). The alternatives insecurity (6.7%) and other feelings (3.8%) had low adherence. The alternative indifference was not mentioned by this group, as shown in figure 5.

**Figure 5** – Feelings aroused by the expression gamma ionization – second group



Source: authors.

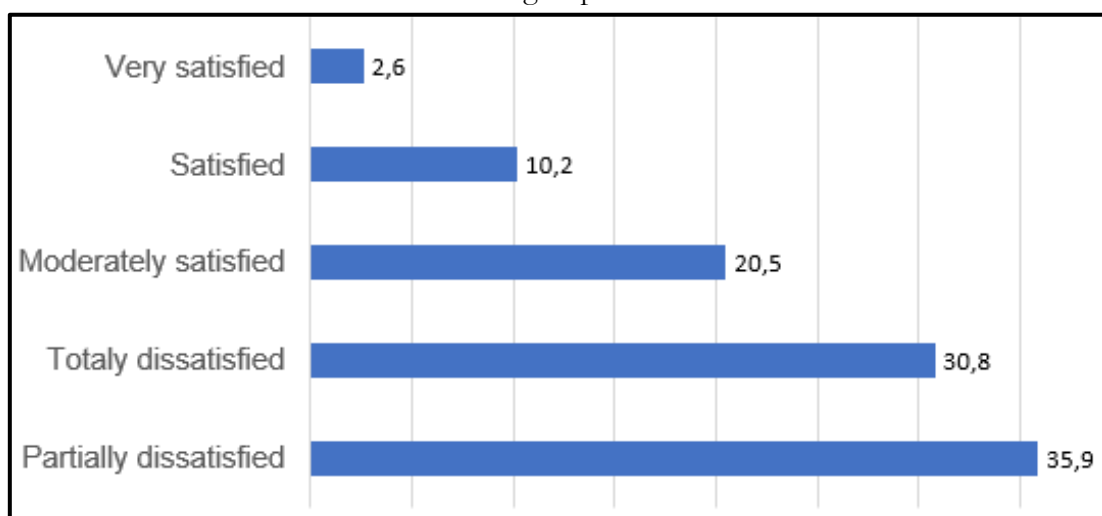
It is highlighted that the formation of this group is more diverse, with professionals from different areas of the restoration system and with the indication that they know more about the benefits that technology brings to the preservation of collections and cultural assets.

Therefore, the positioning of research participants from both groups is observed, regarding the feelings that the expression “gamma ionization” aroused in them. In general, the impression about gamma ionization in the decontamination of collections awakens: positive feelings, curiosity, interest and acceptance from the majority of those surveyed in both groups, with the rates referring to feelings of insecurity or indifference being very low ones.

### 3.5 Satisfaction with sources and means of information on ionizing radiation for decontamination

The indexes obtained regarding the level of satisfaction of research participants, concerning to knowledge of the gamma ionization decontamination technique were as follows, in the first group: very satisfied (2.6%), satisfied (10.2%), moderately satisfied (20.5%), partially dissatisfied (35.9%) and completely dissatisfied (30.8%), as shown in figure 6.

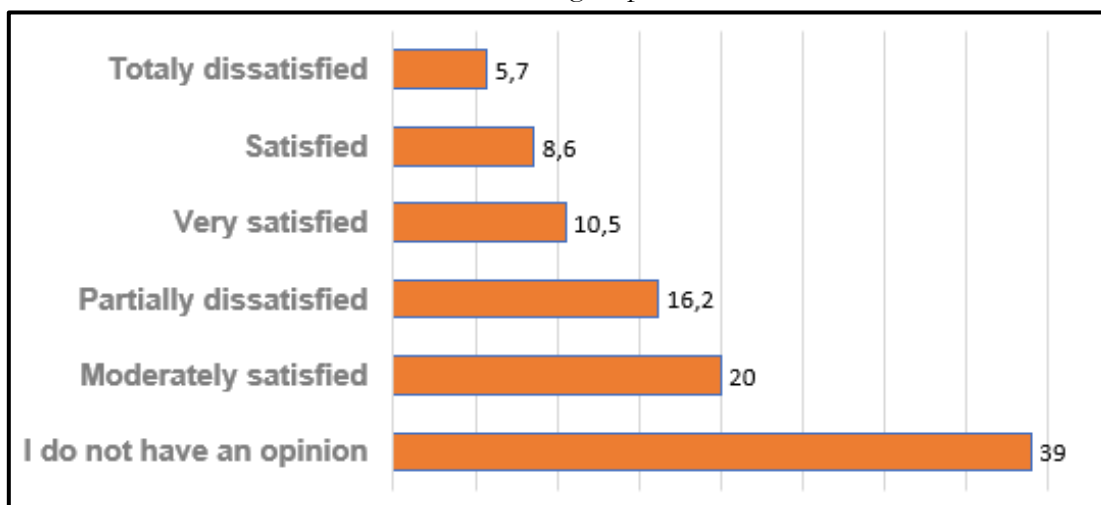
**Figure 6** – Satisfaction with the information obtained from the application of the ionization range – first group



Source: authors.

Respondents from the second group, figure 7, indicated the following rates: very satisfied (10.5%), satisfied (8.6%), moderately satisfied (20%), partially dissatisfied (16.2%), completely dissatisfied (5.7%) and I am unable to give an opinion (39%). There is a perceived need to increasingly reach specialized audiences with information about the gamma ionization technique in the decontamination of collections.

**Figure 7** – Satisfaction with the information obtained from the application of the ionization range – second group



Source: authors.

#### 4. FINAL CONSIDERATIONS

The research, carried out nationwide, demonstrated knowledge at various levels about gamma ionization in the preservation of bibliographic collections and cultural assets. The sources of information for the respondents were also discussed, as well as the knowledge about applying the technique in institutions.

Analysis of the results demonstrate that the gamma ionization technique in collections is attractive to specialized audiences. There is an interest in technology, in the knowledge of its application and in the possibilities used in the conservation of varied collections.

It was noticed that the level of lack of knowledge about gamma ionization and its application in collections is greater in the first group of respondents. The lack of knowledge in both groups may be linked to the non-existence or small number of institutions that have applied the technique, or due to the lack of dissemination of information.

Any lack of interest or misinformation about nuclear technology applied to decontamination or disinfection can be mitigated with adequate communication action, to improve the feasibility of reaching both specialized professionals and the lay public.

## CONFLICT OF INTEREST

All authors declare that they have no conflicts of interest.

## REFERENCES

- [1] COPPOLA, Floriana. *et al.* Effects of  $\gamma$ -ray treatment on paper. **Polymer Degradation and Stability**. v. 150, p. 25-30, 2018.
- [2] CHOI, Jong-il *et al.* Effect of radiation on disinfection and mechanical properties of Korean traditional paper, Hanji, **Radiation Physics and Chemistry**. v. 81, p. 1051-1054, 2012.
- [3] IAEA. **Uses of Ionizing Radiation for Tangible Cultural Heritage Conservation**. Viena: IAEA, 2017. Disponível em: [https://www-pub.iaea.org/MTCD/Publications/PDF/16-17821\\_PUB1747\\_web.pdf](https://www-pub.iaea.org/MTCD/Publications/PDF/16-17821_PUB1747_web.pdf). Acesso em 05 mai. 2021.
- [4] SILVA, Manuela da *et al.* Inactivation of fungi from deteriorated paper materials by radiation. **International Biodeterioration & Biodegradation**, v. 57, p. 163-167, 2006. Disponível em: <https://www.arca.fiocruz.br/handle/icict/39695>. Acesso em 05 mai. 2021.
- [5] SINCO, Patrick. The use of gamma rays in book conservation. **Nuclear News**, p. 38-40, mar. 2000.

- [6] INSTITUTO DE PESQUISAS ENERGÉTICAS E NUCLEARES (IPEN). **Irradiador Multipropósito**, 2020. Disponível em: [https://www.ipen.br/portal\\_por/portal/interna.php?secao\\_id=2500&campo=1798](https://www.ipen.br/portal_por/portal/interna.php?secao_id=2500&campo=1798). Acesso em 05 mai. 2021.
- [7] VASQUEZ, Pablo Antonio Salvador; NAGAI, Maria Luiza Emi. A Contribuição da tecnologia de ionização gama na recuperação de acervos do patrimônio cultural. **Revista do Arquivo Público do Estado de São Paulo**, São Paulo, ano VI, n. 11, p. 101-110, out. 2020.
- [8] VERVLIET, J. Mould disinfection through gamma radiation in The Peace Palace Library. *In*: INTERNATIONAL ATOMIC ENERGY AGENCY. **Uses of Ionizing Radiation for Tangible Cultural Heritage Conservation**. Vienna: IAEA, 2017. p. 113 – 115. Disponível em: [https://www-pub.iaea.org/MTCD/publications/PDF/16-17821\\_PUB1747\\_web.pdf](https://www-pub.iaea.org/MTCD/publications/PDF/16-17821_PUB1747_web.pdf). Acesso em 05 mai. 2021.
- [9] HAVERMANS, J. B. G. A. Introduction, p.1-8. *In*: IAEA. **Uses of Ionizing Radiation for Tangible Cultural Heritage Conservation**. Vienna, 2017. Disponível em: [https://www-pub.iaea.org/MTCD/Publications/PDF/16-17821\\_PUB1747\\_web.pdf](https://www-pub.iaea.org/MTCD/Publications/PDF/16-17821_PUB1747_web.pdf). Acesso em 05 mai. 2021.
- [10] VIEIRA, Sonia. **Como elaborar questionários**. São Paulo: Atlas, 2009.
- [11] WEBER, Andréa F.; PÉRSIGO, Patrícia M. **Pesquisa de opinião pública: princípios e exercícios**. Santa Maria: FACOS-UFMS, 2017. Disponível em <https://repositorio.ufsm.br/bitstream/handle/1/13135/E-book%20POP.pdf?sequence=1&isAllowed=y>. Acesso em 03 mar. 2023.
- [12] LUCIAN, Rafael; DORNELAS, Jairo Simião Mensuração de Atitude: proposição de um Protocolo de Elaboração de Escalas. **RAC**, Rio de Janeiro, v. 19, p. 157-177, ago. 2015. Disponível em <https://www.scielo.br/j/rac/a/xbHN8JRbG6f4N7h3Ms8y7bx/?format=pdf&lang=pt> Acesso em 27 set. 2023.
- [13] MOTA, Janine da Silva. Utilização do Google Forms na pesquisa acadêmica. **Revista Humanidades e Inovação**, v. 6, n. 12, 2019 Disponível em: <https://revista.unitins.br/index.php/humanidadesinovacao/article/view/1106>. Acesso em 26 set. 2023.
- [14] MOREIRA, Daniel Augusto. **O método fenomenológico na pesquisa**. São Paulo, Pioneira - Thompson, 2002.



- [15] HUSSERL, Edmund. **A ideia da fenomenologia**: cinco lições. Petrópolis: Vozes, 2020.
- [16] TERNOSKI, Simão. A pesquisa quantitativa. *In*: TERNOSKI, Simão; COSTA, Zoraide da Fonseca; MENON, Rozeli Aparecida. **A pesquisa quantitativa e qualitativa nas Ciências Sociais Aplicadas**. Ponta Grossa: Atena, 2022. p.18-54. Disponível em: <https://educapes.capes.gov.br/handle/capes/718029>. Acesso em 27 fev. 2023.
- [17] AREA, Maria C. *et al.* Influence of dose and dose rate on the physical properties of commercial papers commonly used in libraries and archives, **Radiation Physics and Chemistry**, v. 96, p. 217-222, 2014.
- [18] BICHIERI, Marina *et al.* Effects of gamma irradiation on deteriorated paper, **Radiation Physics and Chemistry**, n. 125, p. 21–26, 2016.
- [19] CORTELLA, L. *et al.* 50 years of French experience in using gamma rays as a tool for cultural heritage remedial conservation. **Radiation Physics and Chemistry**, v. 171, Elsevier, jun. 2020.
- [20] LANE, Silvia T. M.; CODO, Wanderley (org.). **Psicologia social: o homem em desenvolvimento**. 8. ed. São Paulo: Brasiliense, 1989.
- 

## LICENSE

This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. The images or other third-party material in this article are included in the article's Creative Commons license, unless indicated otherwise in a credit line to the material. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>.

## Annex - Questionnaire applied, prospecting knowledge and attitudes towards gamma ionization (closed questions)

Do you know what gamma ionization or ionizing radiation is?

- I know a lot.
- I know.
- I know moderately.
- I'm partially unaware.
- I'm completely unaware.

Do you know that gamma ionization can be applied to the decontamination of collections?

- I know a lot.
- I know.
- I know moderately.
- I'm partially unaware.
- I'm completely unaware.

The expression gamma ionization in the decontamination of collections awakens you: (tick one or more of the alternatives)

- curiosity.
- interest.
- acceptance.
- indifference.
- insecurity.
- other feeling(s).

Are you satisfied with the level of information you obtained about the application of gamma ionization in the decontamination of collections?

- very satisfied.
- satisfied.
- moderately satisfied.
- partially dissatisfied.
- completely dissatisfied.
- I am unable to give an opinion.

Are you interested in obtaining more information about the application of gamma ionization in the decontamination of collections?

- very interested.
- interest.
- moderate interest.
- partial disinterest.
- total disinterest.

How would you like to obtain information or more information about the application of gamma ionization in the decontamination of collections? (tick one or more of the alternatives)

- documents (book, scientific article, newspaper, etc.);
- social networks (Instagram, Whatsapp, Facebook, Twitter, lives, etc.);
- websites;
- videoconferences;
- professional events (seminar, congress, workshop, course, dialogue circle, debate, etc.);

- other sources;
- I would not like to obtain information.

With whom did you share information about the application of gamma ionization in the decontamination of collections? (tick one or more of the alternatives)

- professional colleague(s);
- other professional(s);
- family member(s);
- friends;
- social network group(s);
- I never shared information.

Do you know if the collection of the institution where you work/works has already been subjected to any decontamination technique?

- Yes.
- No.
- I am unable to give an opinion.

Do you consider the conservation conditions of the collection of the institution where you work/act satisfactory?

- very satisfactory.
- satisfactory.
- moderately satisfactory.
- partially unsatisfactory.
- completely unsatisfactory.

Would you feel safe working with collections/documents decontaminated by gamma ionization?

- very safe.
- insurance.
- moderately safe.
- partially insecure.
- totally insecure.

Would you prefer to apply another collections decontamination technique to gamma ionization in the institution where you work/work?

- Yes.
- No.
- I am unable to give an opinion.

Would you recommend to your professional colleague the application of gamma ionization in the decontamination of collections?

- I would fully recommend it.
- would recommend.
- would recommend with restrictions.
- would not recommend.
- I am unable to give an opinion.