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ADOPTED PRACTICES FOR THE DISPOSAL OF DRUG WASTE AND SANITARY HOUSEHOLD PRODUCTS BY THE HIGH SCHOOL STUDENTS

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Abstract: The study objective was to obtain information on the practices adopted by the students of the High School of Course technical of Environmental Sanitation and Biotechnology of Cedup Renato Ramos da Silva School, in Lages, SC for the disposal of residues of medicines and household cleaners in their homes. This study was developed by students of scientific initiation of High School (PIBIC/EM). For data collection a semi-structured questionnaire was applied to the students of the respective courses during the period of their classes in the Institution. It was observed that 63% do not have knowledge about the correct procedure of disposal of drug residues and 55.6% still discard the expired drugs in the common trash. Regarding household cleaning products, 90.1% of the participants do not know how to dispose of these residues in their homes, despite frequent use (83.8%). Concerning residues of insecticides, rodenticides and repellents, about 50% of the participants discard the waste in the common bin and 44% do not know how to dispose of these products. Overall, this study showed that High School students from the

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Environmental Sanitation and Biotechnology technical Course inappropriately dispose of the drug residues and sanitary household products in their homes. Thus, it emphasizes the importance of including the topic about waste management in basic education courses.
Keywords: Waste disposal. Medication. Household cleaning products.

Práticas adotadas para o descarte de resíduos de medicamentos e saneantes domissanitários por alunos da educação básica

***Resumo**: Este estudo teve como objetivo levantar informações sobre as práticas adotadas pelos alunos de Ensino Médio do Curso técnico em Saneamento Ambiental e Biotecnologia do Cedup Renato Ramos da Silva de Lages, SC para o descarte dos resíduos de medicamentos e saneantes domissanitários em suas residências. O estudo foi desenvolvido por estudantes de iniciação científica do Ensino Médio (PIBIC/EM). Para a coleta de dados foi aplicado um questionário semiestruturado aos alunos do respectivo curso durante o período de suas aulas na Instituição. Observou-se que 63% não têm conhecimento sobre o procedimento correto de descarte dos resíduos de medicamentos e 55,6% ainda fazem o descarte dos medicamentos vencidos em lixeira comum. Com relação aos produtos domissanitários, 90,1% dos participantes desconhecem a forma de descarte desses resíduos em suas residências, apesar do uso frequente (83,8%). Já quanto relação aos resíduos de inseticidas, raticidas e repelentes, cerca de 50% dos participantes descartam os resíduos na lixeira comum e 44% desconhecem a forma de descarte desses produtos. No geral, este estudo mostrou que os estudantes do Ensino Médio do Curso técnico em Saneamento Ambiental e Biotecnologia não descartam adequadamente os resíduos de medicamentos e saneantes domissanitários gerados em seu domicílio. Dessa forma, enfatiza-se a importância da inserção do tema sobre gestão de resíduos nos cursos de formação básica.*
***Palavras-chave**: Descarte de resíduos. Medicamentos. Produtos domissanitários.*

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1 INTRODUCTION

The management of waste coming from industrial, domestic, commercial, agricultural and health service activities represent one of the great environmental worries of Brazilian cities and a challenge to professionals of the environmental field and health service

providers.[1] The inadequate discard of this waste can caused environmental contamination, silting, floods, proliferation of disease vectors, along with visual pollution and stink.[2]

In Brazil, the management of solid waste has progressed due to the publishing of technical norms and legislation advancements, but there still are gaps to be investigated and improved when it comes to treatment and final disposition, mainly for residential drug waste[3] and sanitary household products. The publication, in 2010, of the Solid Waste National Policy (PNRS) represented an important advance for waste management in Brazil, as it brought a set of principles, objectives, instruments, guidelines, goals and actions with the goal of providing an integrated and environmentally correct management of solid waste. In chapter II, clause 3, there are definitions to be comprehended for effect of the law among others, "environmentally adequate final disposition" and the ordered destination of "residue" in landfills in a way to avoid damage or risks to public health, to safety and to minimize the adverse environmental impacts.[4] PNRS has innovated in emphasizing the cooperation between different levels of government, the involvement of the business sectors and further social segments, instituting shared responsibility for the life cycle of products, prescribing obligations to all those involved in solid waste production.[4,5]

In Brazil, drugs are integrating the Health Service Waste category (RSS) and can be framed in the reverse logistics system, whose objective is collecting unused drugs, expired or not, in order to reduce the negative impact over health and the environment.[6-9, 4] In this system, drug leftovers must be delivered by consumers at the collect points of pharmacies, health centers and further establishments that sell drugs, which are bound by law to receive that waste, while pharmaceutical industries are responsible for the final disposal.[10] However, the reverse logistics implementation still is incipient, restricted to a few cities in an isolated way and normalized by the cities' reach laws. Moreover, in present legislations there are no clear instructions about expired drugs, treatment leftovers and packages discard which must be adopted by the Brazilian population.

The class of household cleaners is defined as "substances or preparations destined to household sanitation, disinfection or disinfestation, in collective or public environments."[11] Products used for the control of disease vectors in the household environment are mainly pyrethroid and pyrethrin insecticides, the main causes for intoxication in the household environment.[12] According to the authors, despite the cleaners being potentially toxic they are not classified and inspected as pesticide. It is stressed that in agriculture, the active

principles of pyrethroid and pyrethrin basis are considered and inspected as pesticide, since they are used for the handling of agricultural pests and can offer risk of contamination to health and the environment. Thus, there is at least one contradictory situation, because when used for agriculture, they are seen as dangerous products, whose sale must be made through the use of agronomic receipt, but when used in the residences they are freely sold without any control.

Studies have shown that expired drugs and treatment leftovers have been discarded in domestic trash, in the toilet or in the sink.[13,14] According to 2006's[13] study, around 20% of used drugs in the country are discarded in household trash or sanitary sewage. This scenario is similar to disposition of unwanted pharmaceutical products waste in southeast England, where the study with 400 families showed that 63,2% of participants related discarding the products in the domestic trash, 21,8% returned them to the pharmacies and 11,5% in the sink or the toilet.[15]

However, when the drugs are discarded inadequately they can contaminate various environmental matrices and cause risks towards health and the population, due to their different pharmacological characteristics and there is nothing about the handling and final disposition of the produced waste.[3] Furthermore, another hindrance on the healthcare services waste management refers to the lack of knowledge from the health services providers about the correct procedures to be adopted in relation to the segregation and storage the contaminated waste.[16]

Thus, the produced waste discard in Brazilian cities is a great challenge to society, the government and the professionals of the field like the Environmental Sanitation and Biotechnology technicians for the promotion of environmental safety. Considering the stated, this research had as objective to raise information about disposal of drugs and household cleaners waste by the students of high school of the Environmental Sanitation and Biotechnology course technical of Cedup Renato Ramos da Silva in Lages, State of Santa Catarina, in their respective residences.

2 **MATERIAL AND METHODS**

This study had a quantitative and descriptive field study approach. The study took place in Centro de Educação Profissional (Cedup) Renato Ramos da Silva, a professional public school, situated in the City of Lages, State of Santa Catarina, Southern Region of Brazil. The City is located in Latitude: 27°48'58" S, Longitude: 50°19"34" W at an altitude of 884 meters.

The participants of the study were all the students of the Educational Center enrolled in the Environmental Sanitation and Biotechnology courses of the institution and that manifested interest in participating on the study, signing freely and spontaneously the Free and Clarified Consent Term (TCLE).

Thus, the studied population was constituted of 99 students, 56 which were enrolled on the Environmental Sanitation vocational course and 39 on the Biotechnology vocational course. The other four individuals didn't identify what course they were enrolled in. This research has been approved by the Uniplac's Research Ethics Committee according to advice nº 095/13.

The data collection was accomplished in the period of April to May 2017, through the application of a structured questionnaire composed of 13 closed questions about the adopted practices of discard of: packages and drug leftovers, expired drugs, antibiotics and household cleaners. For data collection, the teachers of the respective courses were requested a period of 30 minutes during their classes for the distribution and filling of the questionnaires by the students. After permission from the teachers, the researchers distributed the questionnaires to the participants and instructed them about the filling and devolution of the questionnaires. Afterwards, the researchers collected the answered questionnaires.

After collection, the obtained data was tabulated in an Excel spreadsheet and submitted to descriptive analysis (average and percentage).

3 **RESULTS AND DISCUSSION**

3.1 DISPOSAL OF DRUG WASTE

About the disposal of medicines, 63% of the Environmental Sanitation and Biotechnology students informed to have knowledge about the correct procedure of medicine residue disposal. However, 55.6% still discard the overdue drugs in domestic trash bin and 18.2% do not know the correct way to disposal them. Only 8.1% returns to the organ that trades or discards in a specific container for chemicals (12.1%) (Figure 1).

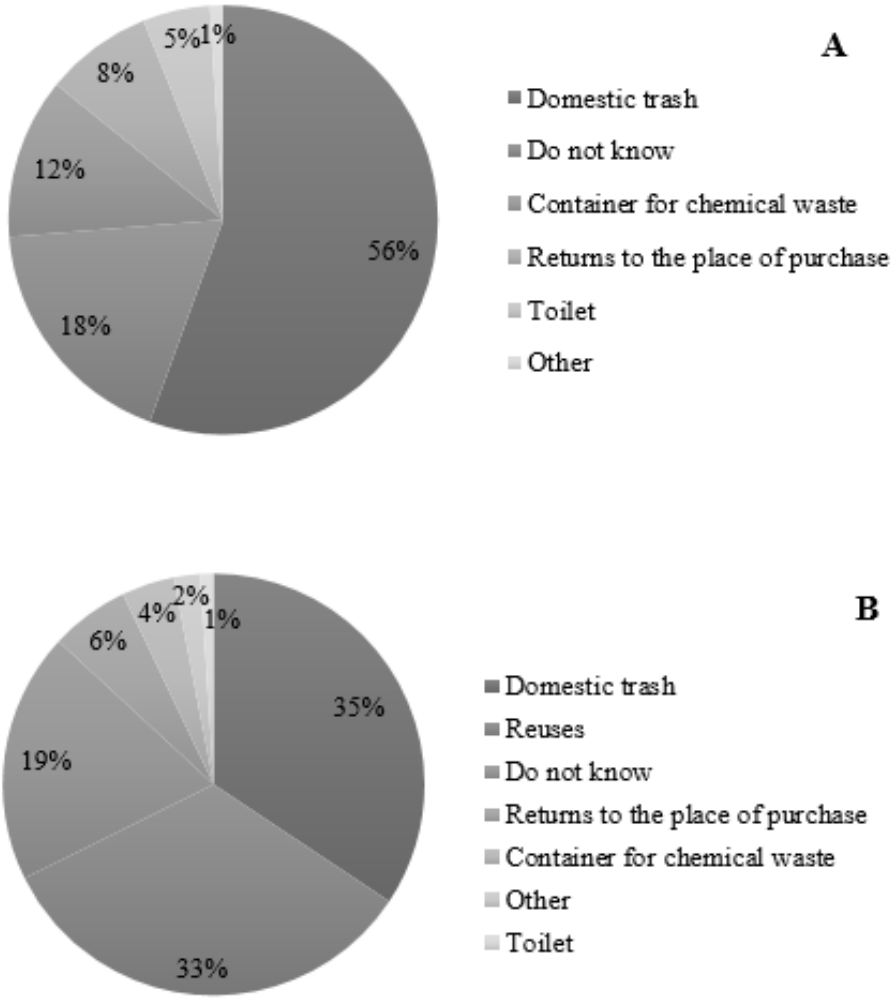

Figure 1 – Wastes of expired drug residues (A) and leftovers of drugs (B) by students high school of the Environmental Sanitation and Biotechnology technical Course of Cedup Renato Ramos da Silva in Lages, SC, 2017

Likewise, 34.3% of the participants discard the leftover drugs in the domestic trash or reuse (33.3%). The majority of participants (61.6%) discarded the antibiotic bottles and disposed them in the domestic trash bin and 17.2% don't know the destiny of such waste (Figure 2). In addition, this study showed that the training of environmental technicians, such as the Environmental Sanitation and Biotechnology courses analyzed, are not preparing professionals to act and operate in the management of health service waste and sanitizers.

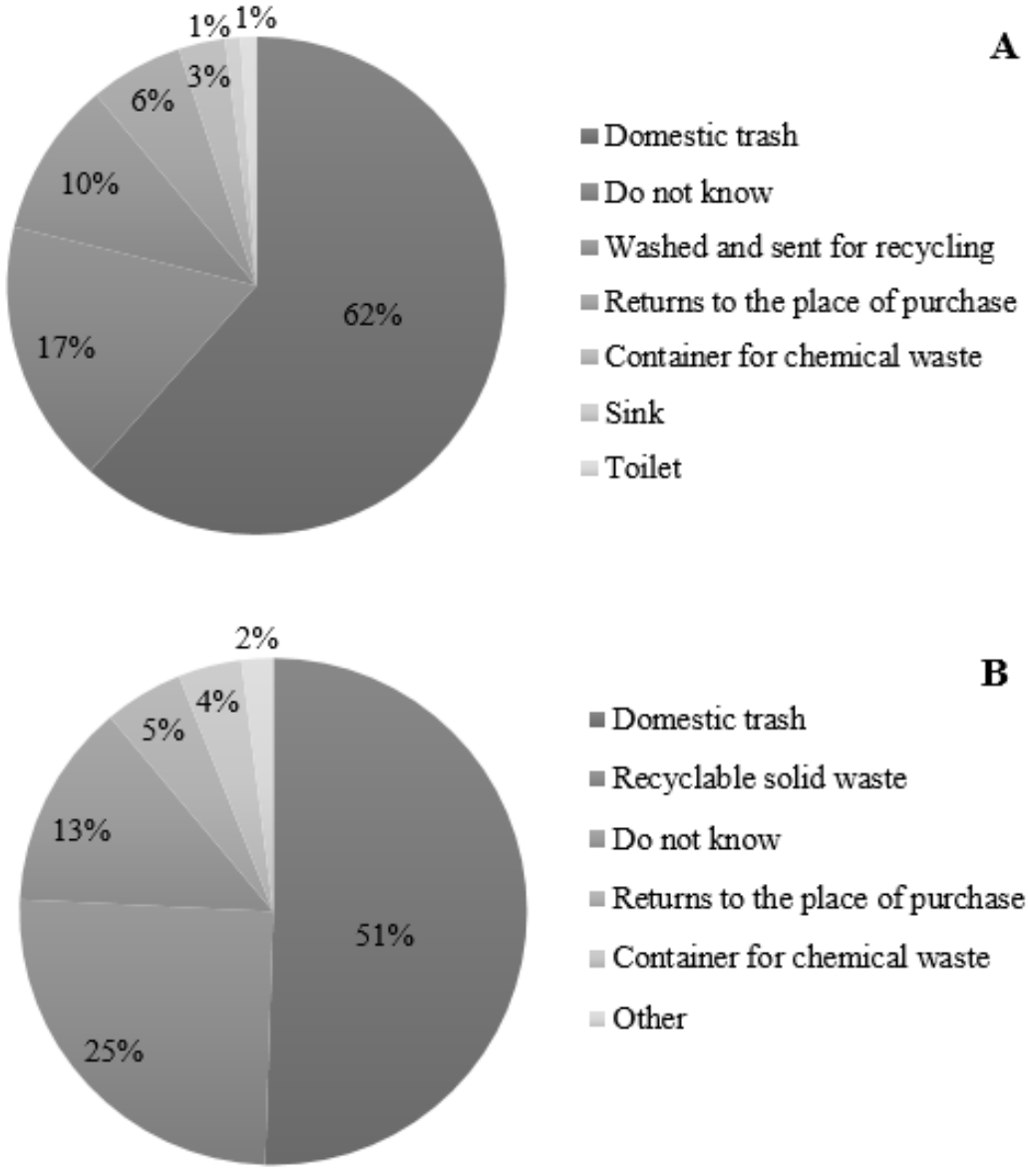

Figure 2 – Forms of residue disposal of antibiotic bottles (A) and drug packages that had contact with the drug (B) by the students high school of the Environmental Sanitation and Biotechnology technical Course of Cedup Renato Ramos da Silva in Lages, SC, 2017

In Brazil, studies addressing the management of drug residues have shown that the disposal of treatment leftovers, expired drugs and packaging has been inadequate.[13, 14, 17-19] For example, in the City of Santos, in São Paulo, 71% of the interviewees stated that they discard their pharmacological residues in household waste.[17] Likewise, in the municipality of Cruz Alta, RS, 65.7% of the residents reported discarding overdue or damaged medications in the common garbage, 18.6% discharge in the toilet and only 8.8% take overdue or damaged medicines to the posts collectors in pharmacies or drugstores, health posts and landfills.[19] In this same research it was observed that 57.1% of the interviewed population never received any type of guidance about the place to return their medications. The scarcity of drug collection points and lack of information and guidance from the health professionals themselves is a reality of the Brazilian municipalities, which contributes to the inadequate disposal of medicines in households.[18]

Other countries in development also have difficulties in disposing health care waste properly. For example, in Saudi Arabia, a study of 767 residents showed that 62.9% of the people discarded the medicines of human usage in the common domestic waste and 16.6% in the toilet and sink.[20] Another study conducted in the city of Nicosia, Cyprus, with 184 people also showed that unused or expired drugs are disposed in the household waste, followed by the sink and toilet.[21]The disposal of overdue drugs in the domestic waste may be harmful to the public health, considering that there are still individuals who survive from the sale of solid waste. In addition, the disposal of overdue drugs and leftovers directly into the sanitary discharge or bathroom sink causes the accumulation of drugs in the wastewater system, since most of the times, water treatment systems are not able to eliminate residues of such drugs.[22]

In the plateau of Santa Catarina there are areas of outcropping and direct recharge of the Guarani Aquifer which represents a strategic reserve for the water supply in the state. In the Municipality of Lages, this natural resource is at risk of contamination due to irregular occupation, lack of urban planning, drainage of untreated effluents and inappropriate waste disposal in the areas of outcrop and recharge of the aquifer.[23] Although the present study has shown a low percentage of participants discarding leftovers and medications, including antibiotics in the toilet / sink, the medicines drugs can reach rivers and streams that seep into the city, infiltrate soil and aquifers. Since only about 25% of the population of

Lages is served with sanitary sewage and 40% of the sewage collected is treated, so many drug residues can contaminate surface and groundwater.[24]

The review study showed the occurrence of about 80 drug compounds and drug metabolites in the aquatic environment, reported in studies conducted in Austria, Brazil, Canada, Croatia, England, Germany, Greece, Italy, Spain, Switzerland, the Netherlands and the USA.[25] Pharmacological compounds for human use have not been removed by conventional treatment of municipal sewage treatment plants and are leached through the soil, contaminating groundwater, as was the case in Germany where clofibric acid, carbamazepine, primidone or iodinated contrast agents were detected in groundwater.[25] A study carried out along the Atibaia watershed, state of São Paulo, also showed seven antibiotics of human use in the surface water of the region.[26]

The data collected in the present study showed that the final destination of the largest percentage of packaging, leftovers and expired drugs discarded by the respondents is the sanitary landfill, because when such waste is disposed in the domestic waste, it is collected and transported by the solid waste collection system and deposited in the landfill. Another worrying issue is the lack of knowledge about the ways in which medicines are disposed of in their homes.

Existing legislation includes residues of drugs (leftover and overdue) in Group B (chemical waste) where they are not subjected to a re-use, recovery or recycling process, but they must undergo treatment and disposal specific. The waste drugs in the solid state must be disposed in landfill of hazardous waste – Class I and those in the liquid state shall not be subjected to treatment before the final disposal environmentally appropriate, being forbidden the final disposal in sanitary landfills.[6,8] However, there are still many gaps in the national guidelines, as they do not determine which healthcare services waste do not pose health and environmental risks and could be disposed of in the sewage collection system. In addition, there is no information on which specific treatment are needed[3,18] and there is no instruction for surplus drugs and overdue drugs generated in households.

3.2 DISPOSAL OF SANITARY HOUSEHOLD PRODUCTS

Regarding the disposal of sanitizing residues of residential cleaners, 90.1% of the participants do not know how to dispose these residues in their homes, despite frequent

use (83.8%), such as once a week (17.2%) or once a month (38.9%). In a survey in the Federal District about the use of sanitizing products, where the authors found that 83.5% of the participants reported discarding sanitary containers such as soap, disinfectants, and detergents, among others in the domestic trash.[27] This fact demonstrates that in several regions of the country there is a lack of knowledge about the proper management of residues of household cleaning products, a matter of concern, since organic contaminants such as household cleaning products can reach aquatic environments mainly through urban drainage and drainage system.[28]

About the disposal of insecticide, rodenticide and repellent residues, 45% of the participants discard in the domestic trash, a similar proportion (44%) is unaware of the form of disposal (Figure 3). A similar result was found for discarding overdue products (Figure 3). This is important information since it shows the banalization of the use of these products as innocuous, routine and practical. Besides, they are not considered harmful to health in the medium and long term in the purchase, use and disposal.

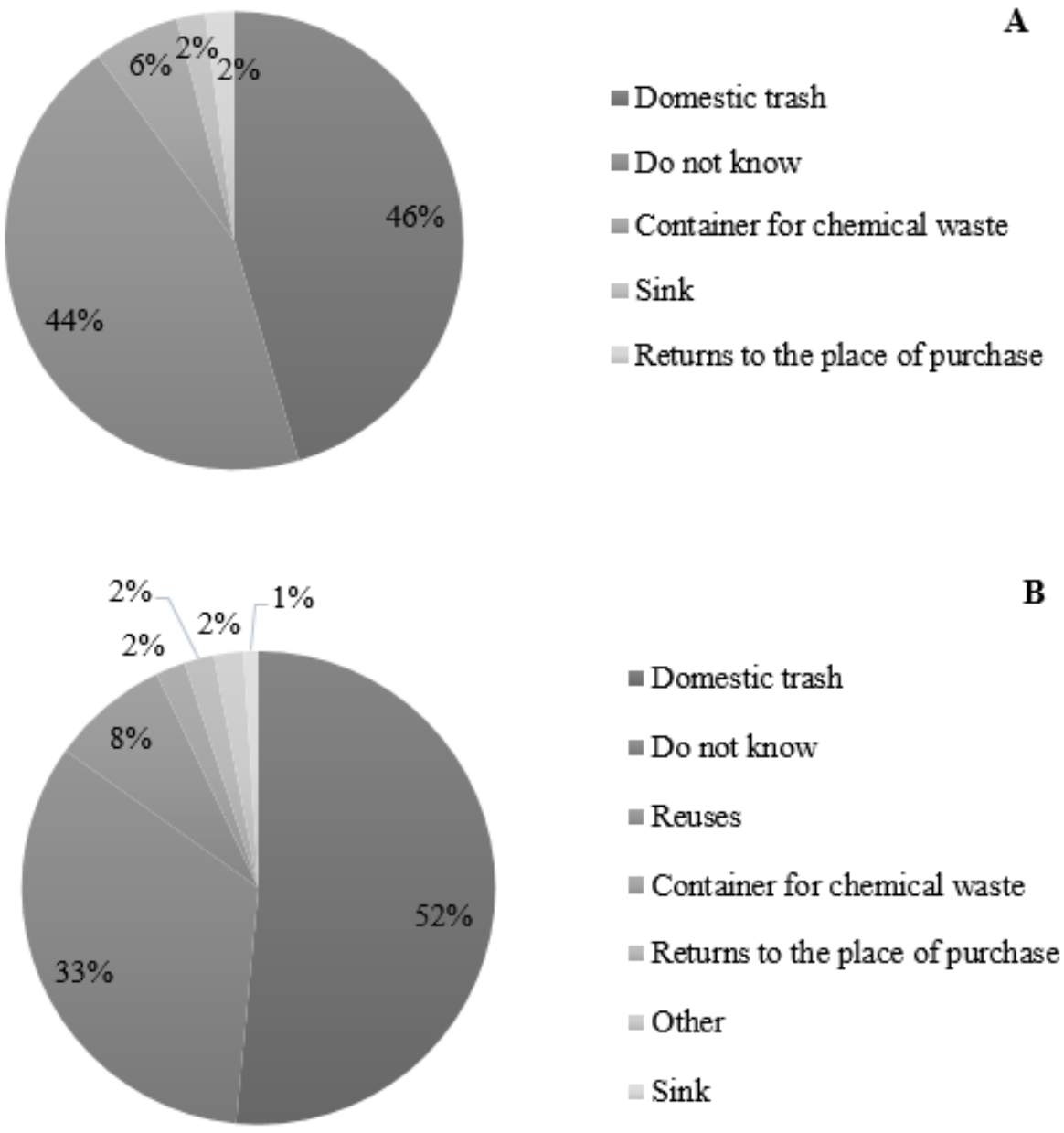

Figure 3 – Forms of disposal of residues of insecticides, rodenticides and repellent household products (A) and disposal of overdue sanitary household products (B) by students high school of the Environmental Sanitation and Biotechnology technical Course of Cedup Renato Ramos da Silva in Lages, SC

Synthetic pyrethroids pesticides are among the most commonly used in the domestic environment. A survey carried out in supermarkets of two municipalities of Santa Catarina identified 126 pesticides for domestic use, 116 of which were insecticide-repellent insecticides, formicides, termicides and ten rodenticides.[29] According to the authors, 81.0% of the analyzed products contained at least one active principle of the chemical class

of pyrethroids[29] when analyzing the labels of these products, found problems that could result in damages to their health of the consumers, of which the following stand out: lack of clarity on the use and care in the handling; omission of the other products present in the formulations, besides the pyrethroids, since several of these products considered "inert" have toxic effects; addition of flavorings to the formulations of domiciliary pesticides that stimulate its use.

The regulation of household pesticides containing pyrethroids needs to be reviewed in Brazil to ensure that components of the formulations and the reported use do not compromise the health of the consumers, as well as to report that household pesticides are similar to agrochemicals.[29]

In Brazil, of registered cases of human intoxication by toxic agent in 2016 by Sinitox, 36.1% of the cases were associated with medicines, 9.9% were domestic and 2% were domestic pesticides.[30] For the state of Santa Catarina, the Information and Assistance Center for Toxicology (CIATox/SC)[31] reported in 2015 that the number of cases of drug intoxication represented 27% of the total and 4% for sanitary household products.

The relationship between domestic intoxication and the use of sanitary household products in Brazil seems to be due to the fact that the average citizen does not perceive these chemical agents as dangerous products.[32] According to the authors, the consumer is not in the habit of reading or not understanding the technical information of the labels, as to its use and chemical composition. In addition, the population, particularly the low-income population, is unaware of the appropriate ways of handling, storing and disposing of household sanitizers, which impacts directly on their health and the environment.[31]

So, it would be important to resemble the labeling of household sanitary disinfectants, which do not have toxicological class, to those of pesticides, as well as to standardize the labeling and disposal of the insecticide used in the domestic environment, informing its toxicological classification and the environmental risk that fact which most often goes unnoticed.[12]

Despite the difficulty in disposing of the sanitary household products, it was observed that these products were stored in isolated locations (32.3%) or in sanitary warehouses (44.4%), and only 2.2% store household cleaning products in the same place as food products. The

storage of sanitary products and insecticides household in the kitchen/pantry, bathroom and bedroom may represent a health risk factor.[12,33]

The reality raises the need to incorporate the thematic about the management of residues of sanitary products and insecticides household and medicines in scientific research, public policies, the media and in the curriculum of professionals who work in the health and environment services.[16,18, 29,31]

4 CONCLUSION

Overall, this study demonstrated that students high school of the technical Course Environmental Sanitation and Biotechnology of Cedup Renato Ramos da Silva in Lages, SC do not adequately discard the residues of household cleaning products and sanitizers generated in their home, emphasizing the importance of discussion and insertion of the theme in their training courses. In this way, the necessary inclusion of the thematic about management of health service and household waste in the curriculum of the high school and vocational education, as well as the standardization of the labeling and disposal of leftovers and packaging of these products, informing its toxicological class and the risk to the environment and health.

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