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INVESTIGATION OF CHARACTERIZATION AND COMPOSITION OF DENTAL WASTES IN SAMSUN CITY CENTER

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ABSTRACT

As a result of daily activities, besides domestic wastes, many hazardous wastes also come out. These wastes constitute hazards in terms of environment and human health. Taking these potential hazards into account, waste must be disposed of in such a way as not to jeopardize the environment and human health. Looking at the overall hazardous wastes, it appears that dental wastes are a small fraction. Although it is thought to be a trivial part, it is in fact an important waste resource, with poor management, complicated infection risk and even heavy metal output from materials such as amalgam. Therefore waste characterization and composition should be determined to develop appropriate waste management systems. Just as dental residues are found in many countries, management of "medical waste control" is carried out by regulations in Turkey as well. In this study, it was aimed to determine the composition and characterization of dentistry wastes of Samsun city center. For this purpose, wastes of faculty of Dentistry, 2 dental clinics and 2 private dental examinations were taken and studied in two different days. In this study, wastes are classified by type, so that percentage distributions are calculated and quantities are examined.

Keywords: *Medical Waste, Dental Waste, Waste Characterization, Samsun.*

INTRODUCTION

Medical wastes are not infectious danger in terms of public and environment when they are properly disposed. The important thing here is to know what the contaminants are and to distinguish them. This process is beneficial for protecting the people and society that collect the waste and it will significantly reduce the costs of disposal operations.

Medical wastes are considered under the title of hazardous waste in many literature. Health care waste are defined from WHO as discarded materials from health care activities that have the potential of transmitting infectious agents to humans [1]. According to this definition, medical wastes are dangerous for human and environmental health. For this reason, management and disposal must be done in certain rules. In most countries dental wastes are regulated under medical waste regulations [2]. Since 2005, medical wastes in Turkey have been collected, transported and disposed of under the control of medical waste regulation.

Dental wastes also form part of the medical waste. In many developing countries dental wastes are ignored because of the lack of quantity. In recent years, a significant increase has been observed in dental wastes. This is seen as an increase in the use of plastic barriers, gloves and mask. These materials are thought to constitute about 90% of the total weight of the waste [3].

Many sources categorize dentistry wastes into different subgroups. This classification is usually household-type wastes, infectious wastes, sharps, radioactive wastes, non-hazardous chemical wastes and hazardous chemical wastes. Even when looking at these subheadings, dental residues seem to have a risk of complicated infection due to the presence of infectious and hazardous wastes.

Protection from these risks is achieved through proper waste management. These wastes are not infectious danger in terms of public and environment when they are properly disposed. The important thing here is to know what the contaminants are and to distinguish them. This process is beneficial for protecting the people and society that collect the waste and it will significantly reduce the costs of disposal operations [4]. Waste management involves well separation, transportation and appropriate disposal method. According to Kızlary, 94.7% of these wastes and 71.15% according to Nabizadeh's work are non-infected wastes [5,6]. With separate collection and quantity tracking, infected waste can be minimized. In addition, the healthcare organizations are

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required to pay medical fees per kg of medical waste they produce, so characterization and quantification will be beneficial in terms of cost.

MATERIALS AND METHODS

Description of Study Area

This study was conducted on the dental centers of Samsun city, located in the north of Turkey, in 2016. Samsun is the biggest city of the black sea and its population is 1,279,884 [7]. There are one School of Dentistry at Ondokuz Mayıs University, one state dental hospital, one oral dental health center, 2 private dental hospital, 2 dental clinics and 99 private dental office in Samsun city center [8]. A total of 384 dentists work in all these health institutions. In order to be generally descriptive, university hospital, 2 clinics and 2 private offices were selected for the study.

Data Collection

Each of the selected health institutions received samples for one day in April and May. The samples are just the wastes of that day. After 6 pm, the wastes collected from the health institutions were weighed within the same day. The wastes were first divided into classes and then each class was weighed separately. It was calculated that the total number of wastes divided into classes constituted the percentage of total waste. The number of patients from the day when the waste was taken from the health institutions was taken and the amount of waste per patient was calculated. Separation and weighing were carried out in a special solid waste laboratory with ventilation system. These operations were performed using dust and germicidal mask, cut and puncture resistant gloves, aprons and tongs.

RESULTS AND DISCUSSION

Separation and Identification of Waste Components

All of the wastes were collected under 4 main headings first, infected, uninfected, sharps and hazardous. Then it is divided into 25 subclasses.

Private Dental Office Solid Waste

It is a health institution that a single physician works with an assistant. The number of patients per day varies between 4-7 people on average. There is no one trained in the separation of wastes. Separate collection of wastes is not carried out and all wastes are accumulated in the same waste bag. It is usually discarded after 1-2 weeks of waiting for the bags to fill. As shown in Table 1, the waste amounts of April and May are reported for the two offices.

Table 1. Classification and Quantities of Waste from Private Dental Office I and II.

		Private Dental Office I				Private Dental Office II			
		April (gr)	May (gr)	Average (gr)	Gr/per	April(gr)	May (gr)	Average (gr)	Gr/per
INFECTED WASTE	NUMBER OF PATIENTS	6	3	4,5	-	4	5	4,5	-
	BLOODY PAPER TOWEL	53.5	36	44.75	9,94	19,5	138	78,75	17,5
	SPIT PAPER TOWEL	182,5	58	120,25	26,72	117	176	146,5	32,55
	BLOODY COTTON	22,5	28,5	15,5	5,66	35	75.5	55,25	12,27
	SPIT COTTON	17,5	13	15,25	3,38	30,5	23,5	27	6
	EXTRACTED TOOTH	7,5	2,5	5	1,11	0	31,5	15,75	3,5
	GAUZE	0	0	0	0	0	12	6	1,33
	LATEX GLOVES	226	81	153,5	34,11	38,5	478	258,25	57,38
	SALIVA ABSORBENT	28	10	19	4,22	21,5	22,5	22	4,88
	BLOODY ROLLER	0	18,5	9,25	4,11	6	50	28	6,22
	SPIT ROLLER	10	5,5	7,75	1,72	0	74	37	8,22
	PAPER APRON	10	22	16	3,55	24	36	30	6,66

Table 1 (Continued). Classification and Quantities of Waste from Private Dental Office I and II.

NON-INFEC.	INSEPARABLE COMPONENTS	3,5	0	1,75	0,38	11,5	2,5	7	1,55
	PLASTIC CUP	55,5	20,5	38	8,44	25	29,5	27,25	6,05
	PACKAGING WASTE	132,5	24	78,25	17,38	113	127	120	26,66
	BEESWAX	2	1	1,5	0,33	0	0	0	0
	PLASTIC PARTS	11	21	16	3,55	0	0	0	0
SHARP	SURGIAL BLADES	0,5	0	0,25	0,11	1,5	0	0,75	0,16
	SYRINGES	50,5	22	36,25	8,05	13	19	16	3,55
	SHARPS AND NEEDLES	11,5	9,5	10,5	2,33	0	12,5	6,25	1,38
HAZRD.	DENTAL IMPRESSION MATERIAL	172,5	66	119,25	26,5	52,5	0	26,25	5,83
	MEDICINE LIGHT BULBS	48	20,5	34,25	7,61	22	5,5	13,75	3,05
	LITMUS PAPER	0,6	0,5	0,55	0,12	0	0,7	0,35	0,07
	SUM	992,1	460	698,05	169,32	530,5	1238	922,1	204,81

Table 2. Amounts and Percentage Distribution of Wastes from Private Dental Office I and II

PRIVATE DENTAL OFFICE WASTE			
	Total average waste (gr)	Distribution (%)	Total waste (gr/person)
INFECTED WASTE	533	66	118,44
NON-INFECTED WASTE	144,87	18	32,20
SHARPS AND NEEDLES	35	4	7,77
HAZARDOUS WASTE	97,2	12	21,6
SUM	810	100	**180**

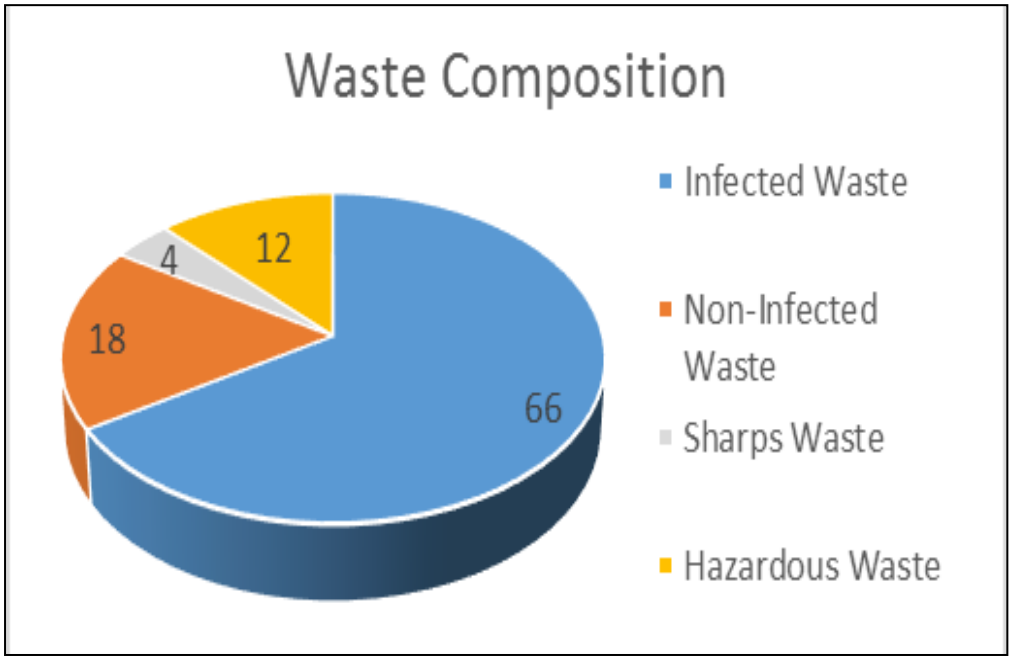

Figure 1. Percentage Distribution of Wastes from Private Dental Office I and II

As there is no separate collection, each class has waste. Table 2 shows the total amount of wastes and their distribution to classes. According to this, it can be said that the amount of waste per patient in a private dental office is 180 gr. In Figure 1, percentages of waste are given, with 66% of them forming infected wastes.

Dental Clinic Solid Waste

Dental clinic I is a clinic where 2 doctors, 2 nurses and 1 cleaning officer work. The average number of patients per month is 53 males, 47 females and 60 children. At the center there are all kinds of treatment for oral and dental health, in-patient and outpatient diagnosis and treatment, dental laboratory and research laboratories. There are no staff trained in medical waste collection and storage. The wastes are collected in medical waste bags, but there is no distinction between domestic, sharps and hazardous waste.

Dental clinic II is a clinic where 5 doctors, 4 nurses and 2 cleaning officer work. The average number of patients per month is 112 males, 86 females and 71 children. In the center there are 5 dental units, 1 general anesthesia and sedatable operative, dental laser devices, advanced technology periapical and panoramic devices. At the center there are 1 staff trained in medical waste collection and storage. The wastes are collected in autoclavable medical waste bags and the yellow plastic boxes specified for the sharps wastes are used. The clinic gives its medical wastes to medical waste collectors for a fee once a week.

Table 3. Classification and quantities of waste from dental clinic I and II.

		Dental Clinic I				Dental Clinic II			
		April (gr)	May (gr)	Average (gr)	Gr/per	April(gr)	May (gr)	Average (gr)	Gr/per
INFECTED WASTE	NUMBER OF PATIENTS	7	9	8	-	8	10	9	-
	BLOODY PAPER TOWEL	53,5	39,5	46,5	5,81	2,5	3	2,75	0,31
	SPIT PAPER TOWEL	105,5	268	186,75	23,34	117,5	62,5	90	10,00
	BLOODY COTTON	5,6	10,5	8,05	1,01	0	0	0	0,00
	SPIT COTTON	2,5	4	3,25	0,41	0	0	0	0,00
	EXTRACTED TOOTH	0	0	0	0,00	0,4	2	1,2	0,13
	GAUZE	18,5	25	21,75	2,72	2,5	11	6,75	0,75
	LATEX GLOVES	304	290,5	297,25	37,16	284	332,5	308,25	34,25
	SALIVA ABSORBENT	9	32	20,5	2,56	81	74,5	77,75	8,64
	BLOODY ROLLER	8,5	15	11,75	1,47	9	11	10	1,11
	SPIT ROLLER	4,5	6,5	5,5	0,69	5,5	17,5	11,5	1,28
	PAPER APRON	97,5	71	84,25	10,53	119,5	126,5	123	13,67
NON-INFEC.	INSEPARABLE COMPONENTS	0	0	0	0,00	7,5	24	15,75	1,75
	PLASTIC CUP	21	37,5	29,25	3,66	80	88,5	84,25	9,36
	PACKAGING WASTE	74,5	140	107,25	13,41	0	0	0	0,00
	BEESWAX	0	0	0	0,00	0	0	0	0,00
	PLASTIC PARTS	10	4,5	7,25	0,91	0	0	0	0,00
SHARP	SURGIAL BLADES	0	0	0	0,00	147	112	129,5	14,39
	SYRINGES	3,5	4,5	4	0,50	23,5	54,5	39	4,33
	SHARPS AND NEEDLES	0	0	0	0,00	0	0	0	0,00
HAZRD.	DENTAL IMPRESSION MATERIAL	42,5	13,5	28	3,50	0	0	0	0,00
	MEDICINE LIGHT BULBS	17	7,5	12,25	1,53	155	120	137,5	15,28
	LITMUS PAPER	0	0	0	0	0	0	0	0
	SUM	777,6	969,5	873,55	109,19	1034,9	1039,5	1037,2	115,24

In Table 3, wastes belonging to both clinics are classified and waste quantities and patient numbers for that day are given.

Table 4 and 5 give the total waste amounts and percentage distributions from clinics and Faculty of Dentistry respectively. From an average, it is about 1 kg of waste per day from a clinic. As shown in Figure 2, 69% of this waste forms infected wastes, on the other hand for faculty of Dentistry this rate is 73 % and this can be seen in figure 3. The amount of waste per patient for a clinic was calculated as 112.42 gr.

Table 4. Amounts and Percentage Distribution of Wastes from Private Dental Office I and II

DENTAL CLİNİC WASTE			
	Total average waste (gr)	**Distribution (%)**	**Total waste (gr/person)**
Infected Waste	658,35	69	77,45
Non-Infected Waste	121,87	13	14,34
Sharps And Needles	86,5	9	10,18
Hazardous Waste	88,87	9	10,46
Sum	955,60	100	**112,42**

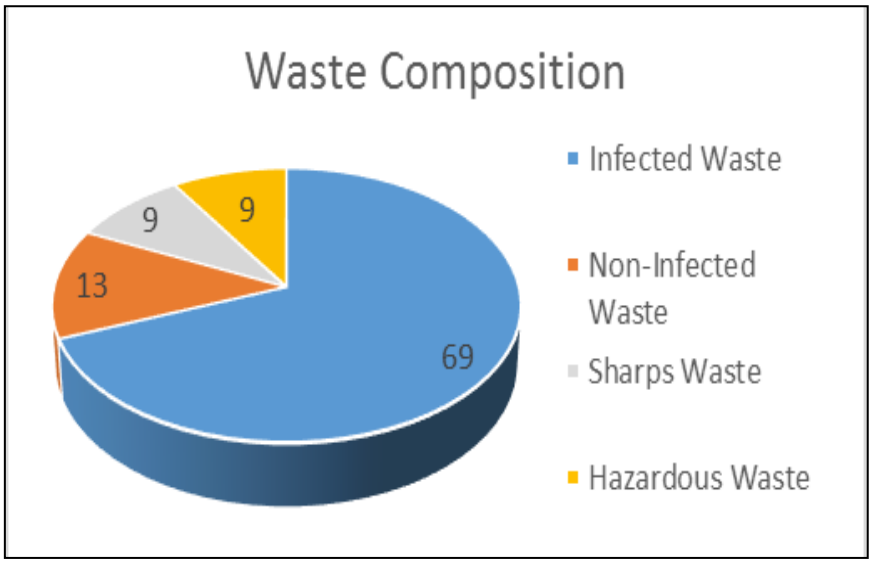

Figure 2. Percentage Distribution of Wastes from Dental Clinic I and II

Faculty of Dentistry

Faculty of dentistry is used as a dental hospital. An average of 16,000 patients per month are treated at the hospital. There are 8 different departments in the hospital. These are pedodontics, periodontology, restorative, oral diagnosis, denture, endodontics, orthodontics and operating room. Due to the high health risk, operating room waste was not included in the weighing process. Pedodontia is a program aimed at relieving the problems of teeth and teeth caused by caries, trauma, hereditary and similar factors in the healthy protection of the dairy and permanent teeth of 0-13 year old children. Orthodontics is a science that investigates the anatomy physiology and histology of soft and hard tissues surrounding teeth and investigates diseases that occur in these tissues. Restorative is a specialist that deals with the treatment and follow-up of all discomforts related to tooth hard tissues, bacteria-originated or without bacteria. Oral diagnosis is the process of diagnosing the patient's x-rays of the mouth region and performing a detailed intraoral examination. The prosthetic department is the unit that provides porcelain tooth, crown, bridge, nail tooth, implant tooth, denture, palate, hooked tooth. The endodontics department is the branch who deals with the problems that have advanced to the dental pulp and treats them. The department of orthodontics is a dentistry that focuses on the placement of the teeth on the jawbone aesthetically and in a taskable manner. As shown in Tables 6 and7, different waste sources are observed in the sections that have different operations.

Table 5. Amounts and Percentage Distribution of Wastes from Faculty of Dentistry

FACULTY OF DENTISTRY WASTE			
	Total average waste (gr)	**Distribution (%)**	**Total waste (gr/person)**
Infected Waste	33361	73	42
Non-Infected Waste	6755,4	15	8,48
Sharps And Needles	632,5	1	1,025
Hazardous Waste	5091,5	11	6,395
Sum	45840,4	100	**57,9**

.**Table 6.** Classification and Quantities of Waste from Faculty of Dentistry. (April)

	Faculty of dentistry (April quantities of waste - gr)									
		Pedodontics	**Periodontology**	**Restorative**	**Oral Diagnosis**	**Denture**	**Endodontics**	**Orthodontics**	**Total (gr)**	**gr/per**
Infected waste	***Number Of Patients***	*84*	*134*	*87*	*104*	*101*	*67*	*199*	*776*	-
	Bloody Paper Towel	2403	193	2098,5	0	722,5	694,5	2215	8326,5	10,73
	Spit Paper Towel	0	1996	0	258	0	0	0	2254	2,90
	Bloody Cotton	0	0	0	0	0	8	0	8	0,01
	Spit Cotton	0	0	0	0	0	0	0	0	0,00
	Extracted Tooth	0	0	0	0	0	0	0	0	0,00
	Gauze	15,5	674	0	24,5	0	0	65	779	1,00
	Latex Gloves	1533	4611	2830	1515,5	815	1096	4190,5	16591	21,38
	Saliva Absorbent	187	141	199,5	0	8	158	53	746,5	0,96
	Bloody Roller	222,5	0	0	0	0	57	84,5	364	0,47
	Spit Roller	275	4	465	0	6	417,5	59,5	1227	1,58
	Paper Apron And Mask	931	1732,5	1204,6	0	201,5	667,5	678	5415,1	6,98
Non-Infec.	**Inseparable Components**	95,5	6,5	385	0	0	62,5	0	549,5	0,71
	Plastic Cup	154,5	370	229,5	0	18	92,5	136	1000,5	1,29
	Packaging Waste	1914	961,5	450	315	70	478	690	4878,5	6,29
	Beeswax	0	0	0	0	0	0	0	0	0,00
	Aluminium Foil	0	143	0	0	0	56	0	199	0,26
	Metal Parts	9	33,5	10,5	0	33	0	349	435	0,56
	Plastic Parts	36	0	54,5	0	50	9,5	48	198	0,26
Sharp	**Surgial Blades**	0	0	0	0	0	0	0	0	0,00
	Syringes	60	0	426,5	0	0	205,5	0	692	0,89
	Sharps And Needles	0	0	0	0	0	0	0	0	0,00
Hazrd.	**Dental Imp. Material**	380,5	202,4	79,5	0	3235,5	0	734,5	4632,4	5,97
	Medicine Light Bulbs	25	9	31	0	0	10,5	5,5	81	0,10
	Amalgam Alloy	0	74,5	0	0	0	0	0	74,5	0,10
	Litmus Paper	4	0	5,5	0	0	0	0	9,5	0,01
	X-Ray Film	0	0	0	0	0	71,5	0	71,5	0,09
	Sum	8245,5	11151,9	8469,6	2113	5159,5	4084,5	9308,5	**48532,5**	**62,54**

Table 7. Classification and Quantities of Waste from Faculty of Dentistry. (May)

	Faculty of dentistry (April quantities of waste - gr)									
		Pedodontics	**Periodontology**	**Restorative**	**Oral Diagnosis**	**Denture**	**Endodontics**	**Orthodontics**	**Total (gr)**	**gr/per**
Infected waste	***Number of patients***	*124*	*174*	*72*	*92*	*121*	*55*	*178*	*816*	
	Bloody paper towel	2104	200	598,42	78,5	807	598,5	2145	6531,42	8,00
	Spit paper towel	0	2092,5	0	0	0	0	0	2092,5	2,56
	Bloody cotton	2,5	0	4	0	0	0	0	6,5	0,01
	Spit cotton	2,5	0	0	0	0	0	0	2,5	0,00
	Extracted tooth	0	0	0	0	0	0	0	0	0,00
	Gauze	4	426	0	22	0	0	57	509	0,62
	Latex gloves	2229	4533	2063,5	1417	99	998	4005	15344,5	18,80
	Saliva absorbent	453	121	286	0	7	122	46	1035	1,27
	Bloody roller	146	0	226	0	0	45	82,5	499,5	0,61
	Spit roller	107,5	0	342	0	0	399	57	905,5	1,11
	Paper apron and mask	702	1355	687	0	88	684,5	568	4084,5	5,01
Non-Infec.	**Inseparable components**	76	0	83	0	0	58,6	0	217,6	0,27
	Plastic cup	281	370,5	224,5	0	23	88	122	1109	1,36
	Packaging waste	1519	830	319	729	202	395	720	4714	5,78
	Beeswax	0	0	0	0	0	0	0	0	0,00
	Aluminium foil	0	0	0	0	0	0	0	0	0,00
	Metal parts	13,5	17	11	0	21	0	296	358,5	0,44
	Plastic parts	53	0	40	0	11	10,2	52	166,2	0,20
Sharp	**Surgial blades**	0	0	0	0	0	0	0	0	0,00
	Syringes	160	81	123	0	10	199	0	573	0,70
	Sharps and needles	0	0	0	0	0	0	0	0	0,00
Hazrd.	**Dental imp. material**	423	87	0	0	3730	0	802	5042	6,18
	Medicine light bulbs	15	0	30,5	0	0	11	6,5	63	0,08
	Amalgam alloy	6	56	0	0	0	57	0	119	0,15
	Litmus paper	2,5	0	5,5	0	0	0	0	8	0,01
	x-ray film	0	0	0	0	0	82	0	82	0,10
	Sum	8299,5	10169	5043,42	2246,5	4998	3747,8	8959	**43463,22**	**53,26**

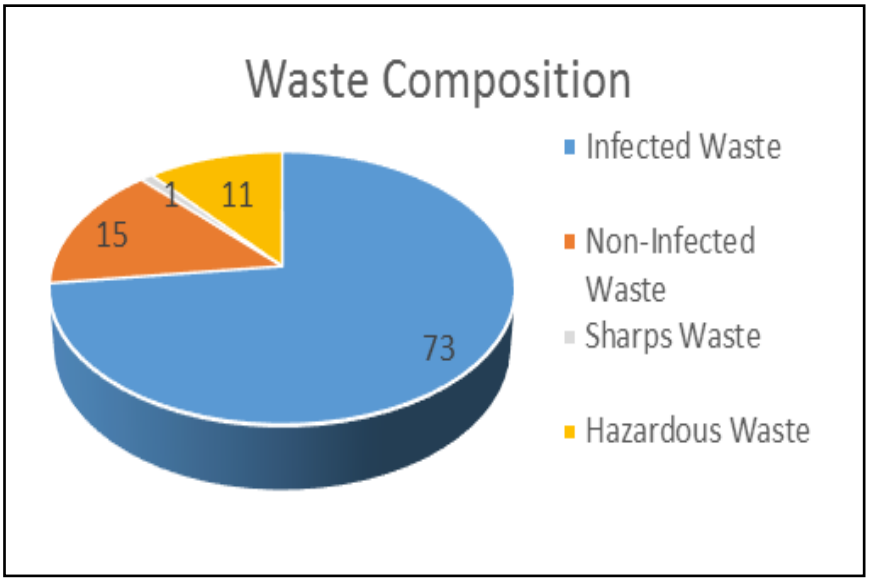

Figure 3. Percentage Distribution of Wastes from Dental Faculty of Dentistry

Looking at all data and graphs, the amount of waste per patient was calculated as 180 gr in private dental office, 112.42 gr in dental clinics and 57.9 gr in faculty hospital. The difference in quantities may be due to differences in disposable materials and procedures. The reason for the low amount in the faculty hospital may be that the waste management is being done more regularly than the other health institutions. There is a serious problem in all organizations, especially if hazardous wastes are not collected separately. If only 5kg of hazardous waste per day is considered to be generated, this amount will be over 100kg per month. In this amount, proper disposal of a waste cannot be achieved. The amalgam in the faculty is an alloy containing heavy metals. In addition, healthcare organizations can reduce the amount of waste by collecting waste separately. Minimization of waste will be beneficial both in terms of health and cost.

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