The Second State of the 3Rs and Resource Circulation and Circular Economy in Asia and the Pacific – Thematic Sections

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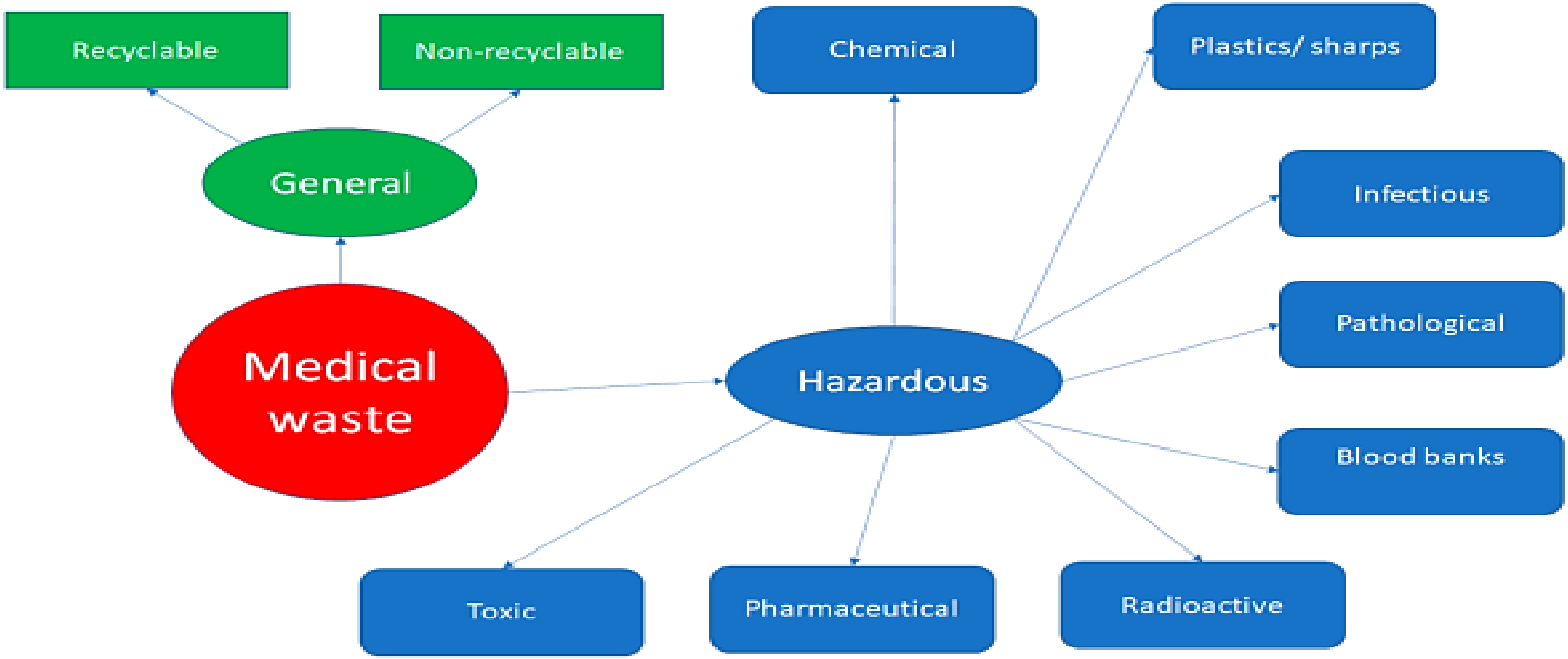
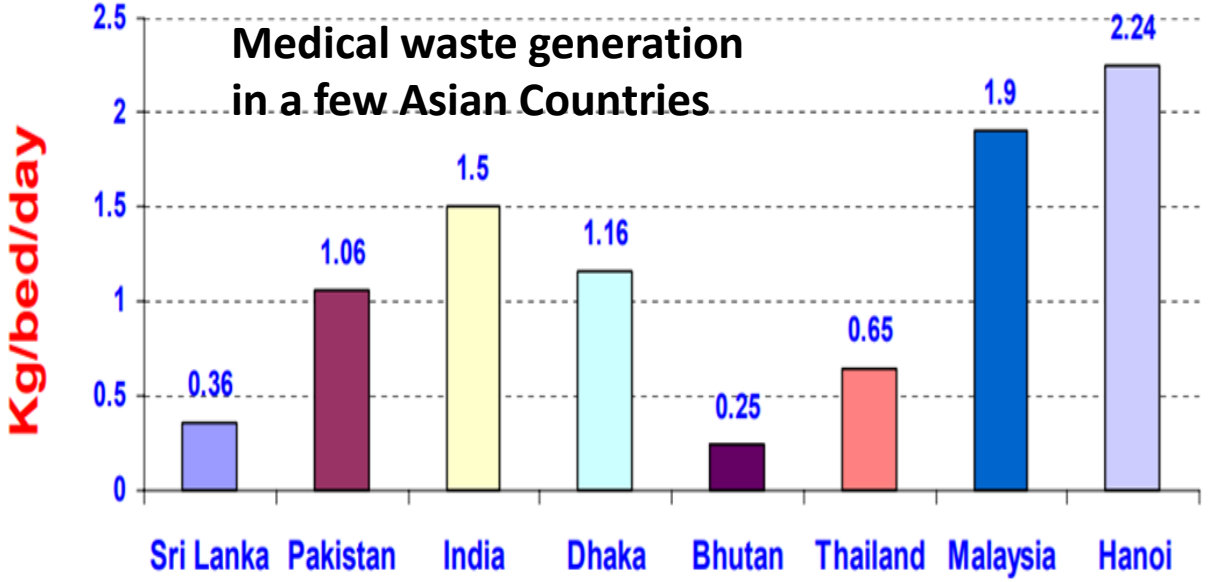
India

Healthcare and Medical Waste



Quantification and Generation (2020-2030) in the region



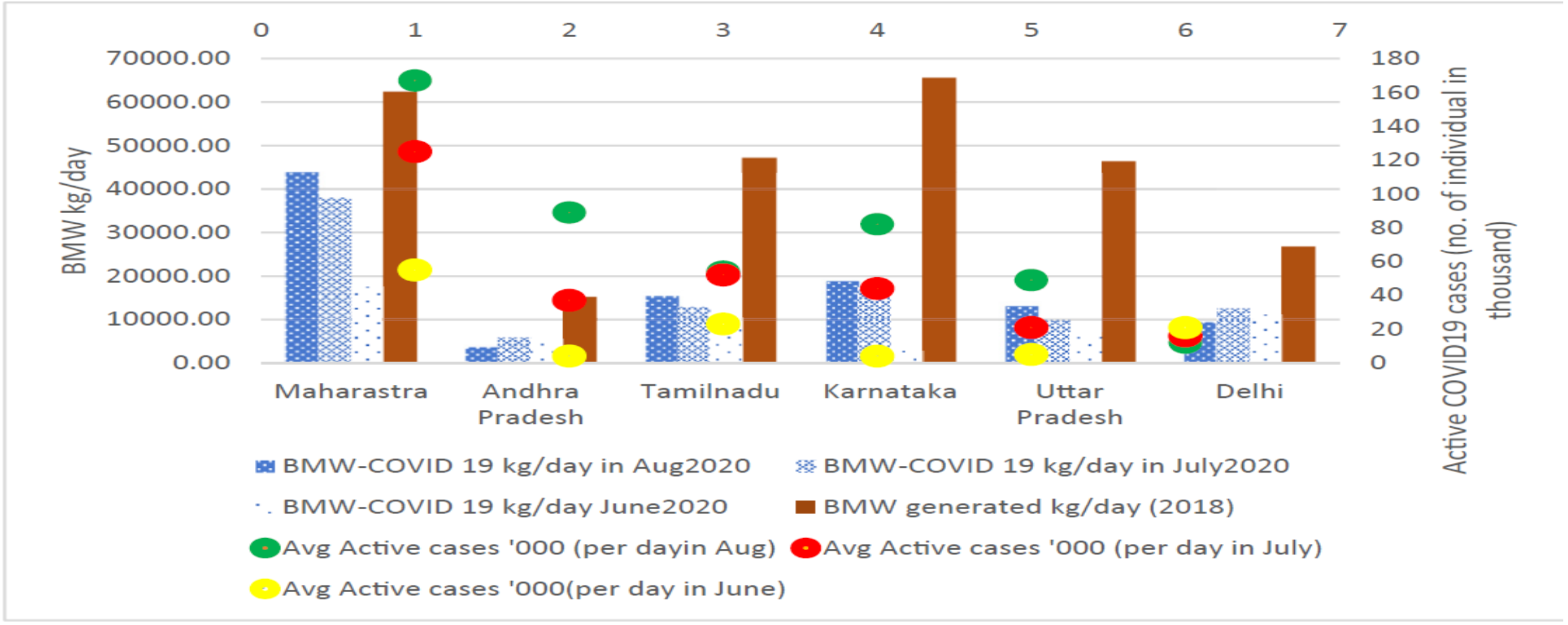
The global growth rate of healthcare waste management costs is estimated to rise from $11.77 billion in 2018, to $17.89 billion in 2026 at a compound annual growth rate of 5.3% (RD Reports and Data, 2020).

High-income countries generate on average up to 0.5 kg of hazardous waste/hospital bed per day; while low-income countries generate on average 0.2 kg.

WHO: in low-income countries, health care waste is not separated into hazardous & non-hazardous waste, causing an increase in the actual quantity of hazardous waste. Such a lack of awareness in developing countries is hindering the growth of the medical waste management market ($13.5 bn in 2019 to 14.9 bn in 2020

HCW generation : Tonnes per day in selected countries (IGES, 2020).

Figure: 3.2.7.3: Active COVID-19 patients & BMW-COVID-19 generated during June–Aug 2020 and business as usual BMW generation in top six affected states. (Source: CPCB, 2018, NGT, 2020a).



Countrywide HCW generation per capita in Africa, America, Asia and Europe

Region	Country & HCW Generated (kg/bed/day)			Region	Country and HCW Generated (kg/bed/day)	Region	Country and HCW Generated (kg/bed/day)
Africa	Algeria 0.96 Cameroon 0.55 Egypt 1.03 Ethiopia 1.1 Mauritius 0.44 Morocco 0.53 Sudan 0.87 Tanzania 0.75	Asia	Pakistan 2.07 Palestine 2.02 Thailand 2.05 Turkey 4.55 Nepal 0.5 Lebanon 5.7 Kazakhstan 5.34 Vietnam 1.57	America	USA 8.4 Canada 8.2 Argentina 3 Brazil 2.94 Ecuador 2.09 El Salvador 1.85	Europe	Netherlands 1.7 Norway 3.9 Ireland 7.7 UK 3.3 Bulgaria 2 Italy 4 France 3.3 Germany 3.6 Greece 3.6 Netherlands 1.7 Norway 3.9 Spain 4.4 Latvia 1.18
Asia	Bangladesh 1.24 China 4.03 India 1.55 Indonesia 0.75 Iran 3.04 Japan 2.15		Jordan 2.69 Korea 2.4 Laos 0.51 Malaysia 1.9				

Biomedical Waste Management in India

The Biomedical waste management Rules, 1998 as revised in 2016 in India requires that no healthcare facility shall establish on-site treatment & disposal facility for BMW, if a service of Common Bio Medical Waste Treatment Facility (CBMWTF) is available within 75 kilometres of travelling distance of the facility. In India at present working with 198 CBWTF and several captive plants. All the public healthcare facilities within reach of 75 kilometres of CBWTF needs to dispose of the BMW through such CBWTF. For the public health care facilities especially in rural areas where there is no CBWTF within range of 75 kilometres, the disposal of BMW can still be made through a CBWTF who is willing to provide treatment services and authorized by the concerned SPCB/PCC to operate in an area beyond 75 Km radial distance. In case of no reach to any CBWTF, the BMW generated from HCFs is disposed in captive treatment and disposal facility or by deep burial pit as authorised by the respective SPCB/and as specified in these guidelines. Nearly 21,870 HCFs have their own treatment facilities and 1,31,837 HCFs are using the CBMWFs. The Biomedical Waste Management in India works on effective business model as the rate of mandatory waste disposal per bed (1 – 2 kg/day) is set by the government to be paid to the operators by the Health Care Units/ Hospitals. Biomedical Wastes generated in the units are segregated in four colour bins as per the rules in India.

Table 3.2.7.2: Hospital waste legislation and regulatory authorities. (Khan, et al., 2019)

Country	Regulatory authority	Legislation
India	Ministry of Env. and Forests	Bio-Medical Waste (Management and Handling) Rules, 2016
Mauritius	Ministry of Health, Ministry of Environment	Public Health Act, 1925 and Standards for Hazardous Waste Regulations, 2001
Laos	Ministry of Health	Healthcare Waste Management Regulation, 2004
Pakistan	Ministry of Environment	Hospital Waste Management Rules, 2005
Vietnam	Ministry of Health	Regulation on Healthcare Waste Management
Nepal	Ministry of Population and Environment	Health Care Waste Management Guideline 2014
Cambodia	Ministry of Health	Technical Guidelines on Healthcare Waste Management 2011
Mongolia	Minister of Health and DG of the National Emergency Mngt	Regulation on labelling hazardous waste" (2006)
The people's Rep. of China	Ministry of Health, State Env Protection Administration	Medical Waste Control Act 380, Regulation 287
Iran	Ministry of Health	Medical Waste Management Regulations, 2008
Bangladesh	Ministry of Health and Family Welfare	Env Assessment & Action Plan for the Health, Population and Nutrition Sector Development Program (HPNSDP) 2011-2016
Australia	Department of Environment and Science	Clinical and related waste Regulation 2019
Singapore	National Environment Agency	Environmental public health (general waste collection) regulations 2000

Health Care Waste Management Legislation – A global perspective

Globally, **there are 168 national laws and regulations that address or mention healthcare waste management, of which 57 relate only to healthcare waste streams, while the other 111 address multiple waste streams.** There is an important distinction here, because the laws often address waste across the board, and may list a number of different waste streams, but generally without substantive content, which poses a problem for the methodology used to collect the data. Thus, laws addressing a single waste stream are generally more substantial than a law that broadly covers several, with a few exceptions (IGES, 2020).

Table 3.2.7.3: Different types of technologies to treat various types of biomedical wastes in Australia

Waste type	Incineration	Autoclaving and shredding	Chemical disinfection using hypochlorite and shredding	Chemical disinfection using peroxide, lime and shredding	Microwave and shredding	Compaction	Landfill
Chemical	✓ (if licensed)	✗	✗	✗	✗	✗	✗
Cytotoxic	✓	✗	✗	✗	✗	✗	✗
Human body parts	✓	✗	✗	✓	✗	✗	✗
Pharmaceutical	✓	✗	✗	✗	✗	✗	✗
Radioactive	✗	✗	✗	✗	✗	✗	✗
Treated clinical	-	-	-	-	-	✓	✓
Untreated clinical	✓	✓	✓	✓	✓	✓ other than animal carcasses and sharps	✗ other than in a scheduled area

Figure 3.2.7.6. Regulatory framework for Biomedical Wastes (BWM) in India (A. Dehal, et al, 2022)

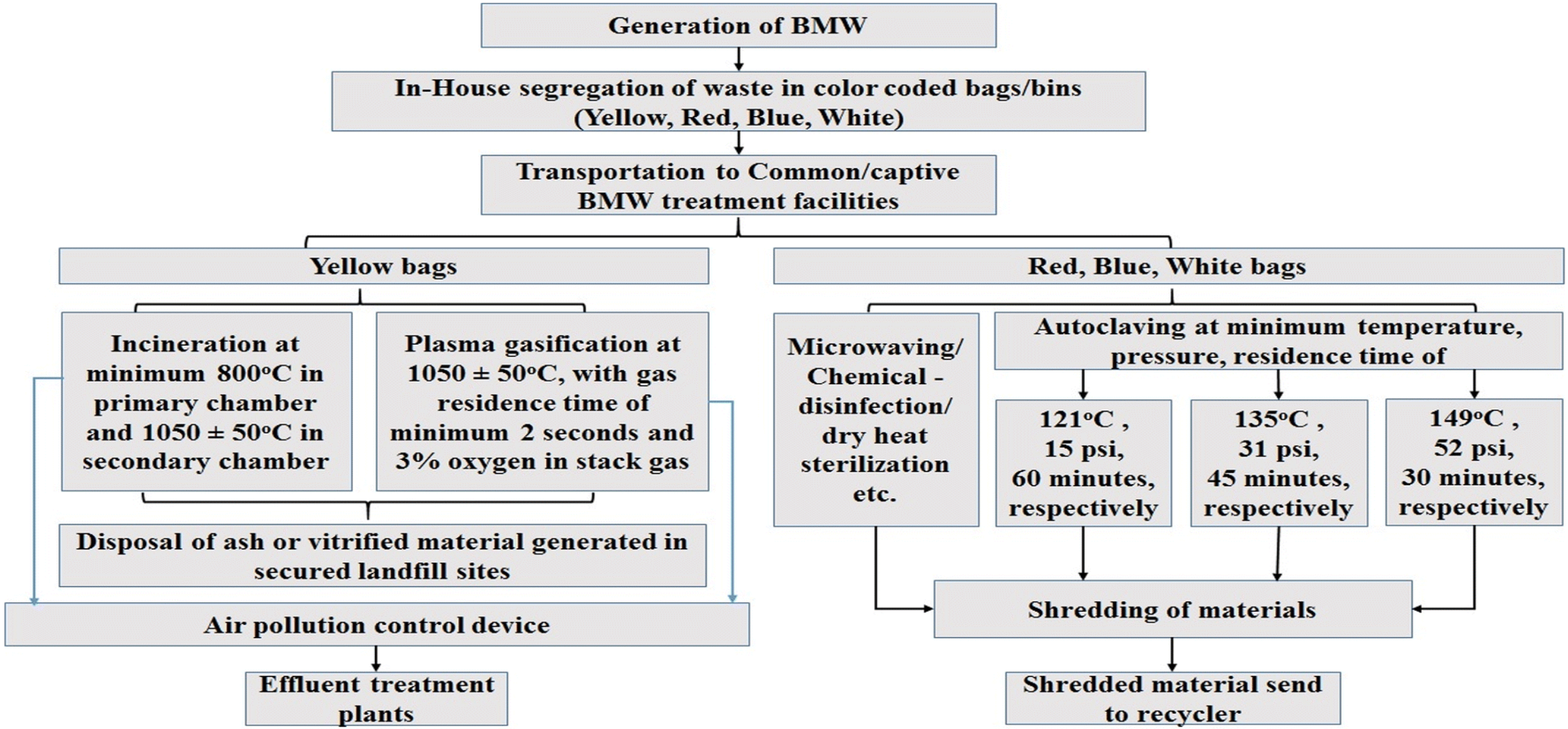


Table 3.2.7.4: General methods employed for disposal of biomedical waste in the various countries.

Name of country	General methods employed for disposal of biomedical waste	References
Mongolia	Open dumping or open burning, incineration, autoclaving	Shinee et al., 2008
India	Landfill, incineration, autoclaving, recycling–reuse	Thakur and Katoch, 2012
Bangladesh	Open dumping	Hassan et al., 2008
Pakistan	Landfill, incineration, recycling–reuse	Ali et al., 2015
The People's Republic of China	Incineration, on-site burning, mix with domestic waste	Gai et al., 2010
Iran	Incineration, open dumping	Bazrafshan and Mostafapoor, 2011
Turkey	Landfill, incineration, autoclaving	Ciplak and Kaskun, 2015

Table 3.2.7.5: Summary assessment on HCWM in selected countries of the Western Pacific Region. (Page no. 59, Status of HCW management in selected countries of the Western Pacific Region, WHO)

COUNTRY	INFORMATION BASE	MANAGEMENT	TRAINING	REGULATION	TECHNOLOGY	FINANCING
AUSTRALIA		–	–	–	–	–
BRUNEI DARUSSALAM	Poor	–	–	–	–	–
CAMBODIA	Good	2	2	4	2	2
CHINA	Fair	3	3	4	3	3
FIJI	Poor	2	2	2	2	1
JAPAN	Good	–	–	–	–	–
KIRIBATI	Poor	2	2	1	2	1
LAO PDR	Fair	2	3	3	3	2
MALAYSIA	Good	3	3	4	4	4
MARSHALL ISLANDS	Poor	2	2	1	1	2
MICRONESIA (FEDERATED STATES OF)	Poor	1	1	2	1	1
MONGOLIA	Good	3	4	4	3	4
NAURU	Poor	1	1	2	1	1
NEW ZEALAND	Fair	–	–	–	–	–
PALAU	Fair	–	–	–	–	–
PAPUA NEW GUINEA	Poor	–	–	–	–	–
PHILIPPINES	Good	3	3	4	3	2
REPUBLIC OF KOREA	Good	4	4	4	5	4
SAMOA	Fair	–	–	–	–	–
SOLOMON ISLANDS	Fair	2	2	2	1	1
TONGA	Fair	–	–	–	–	–
TUVALU	Poor	2	2	1	2	1
VANUATU	Poor	–	–	–	–	–
VIET NAM	Fair	3	3	3	2	2

Note: Rating scheme ranges from 1 = insufficient to 5 = excellent; "–" refers to no data/information

Table 3.2.7.6: Hazardous Healthcare Waste Generation Pacific Island Countries and Territories

Countries	Average daily HCW (kg/occupied bed)	Stock piles (tonnes)
Cook Islands	0.5	0
Fiji	0.8	0
FSM	0.9	0
Kiribati	0.2	0.75
RMI	2.8	76
Nauru	1.4	0
Niue	1.2	0.02
Palau	1.4	ND
PNG	0.7	ND
Samoa	0.6	0.2
Solomon Islands	1.1	ND
Tonga	1	0
Tuvalu	0.3	0
Vanuatu	1	0
All Pacific island countries	0.8	76
American Samoa	ND	ND
CNMI	ND	ND
Tokelau	ND	ND
Guam	ND	ND
French Polynesia	360 Tones/year	0
New Caledonia	324 Tones/year	ND
Wallis and Futuna	ND	ND

SL.No	Country	medical waste generation rate (kg/bed/day)	Health expenditure per capita (US $)
1	India	0.8	59
2	China	0.6	392.8
3	Iran	3.7	375.1
4	Pakistan	0.3	37.9
5	Bangladesh	1.1	31.8
6	Indonesia	0.7	100.4
7	Nepal	2.1	45.1
8	Taiwan	1.9	0
9	Sri Lanka	2.3	151.4
10	Saudi Arabia	0.9	1243.6
11	Palestine	0.8	0
12	Japan	2.3	3733.7
13	Jordan	2.5	314.3
14	korea	0.4	1925.5
15	Kazakhstan	5.4	316.4
16	Lao PDP	0.5	53
17	Viet Nam	0.9	116.7
18	Tailand	2	214.4
19	Lebanon	2.5	655.8
20	Malaysia	1.9	376.1

Asia Region

Figure:3.2.7.7: Structure of a health care PPP model; Source: (Abuzainesh N et al., 2018)

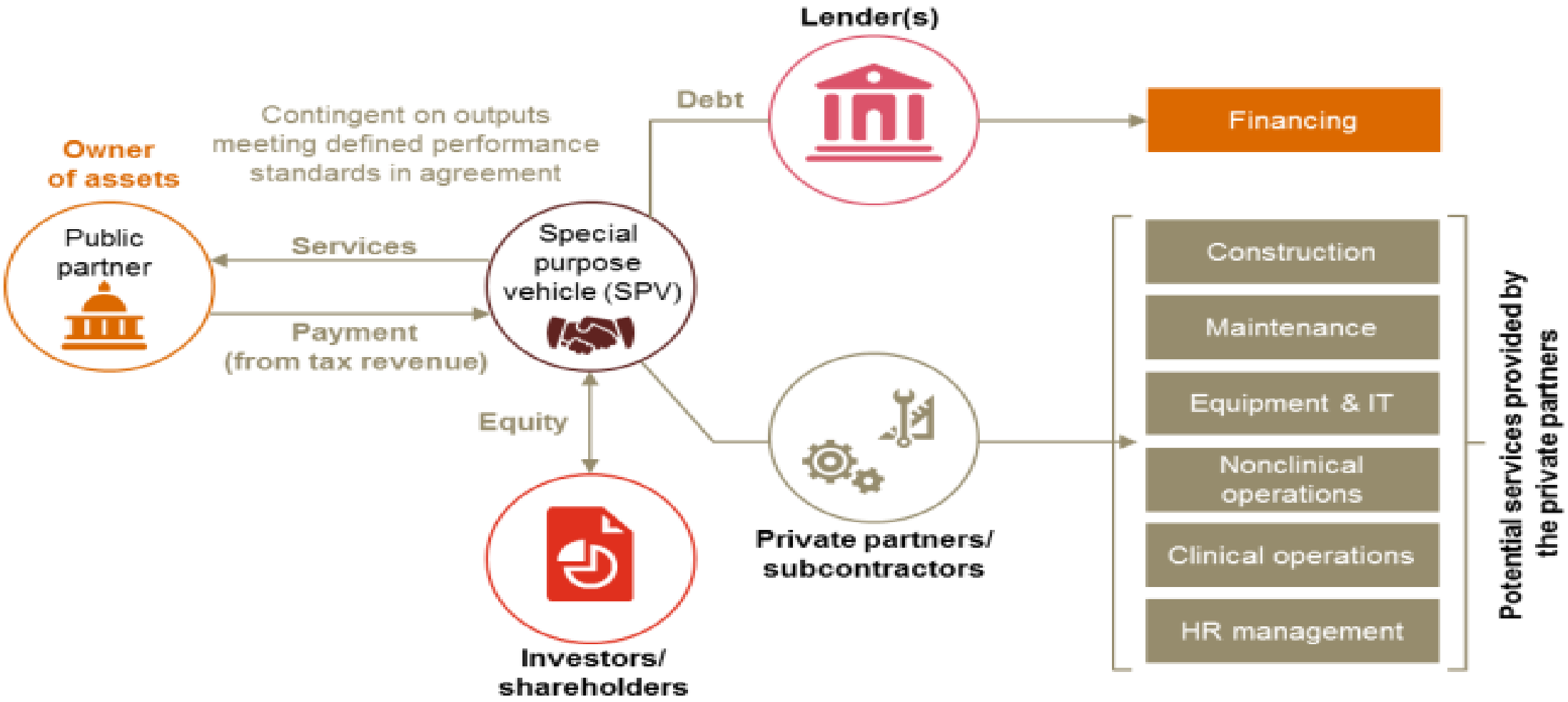


Figure: 3.2.7.8: A schematic diagram on energy/fuels/materials production from medical waste and medical waste fractions via various treatment technologies (Source: Giakoumakis et al., 2021)

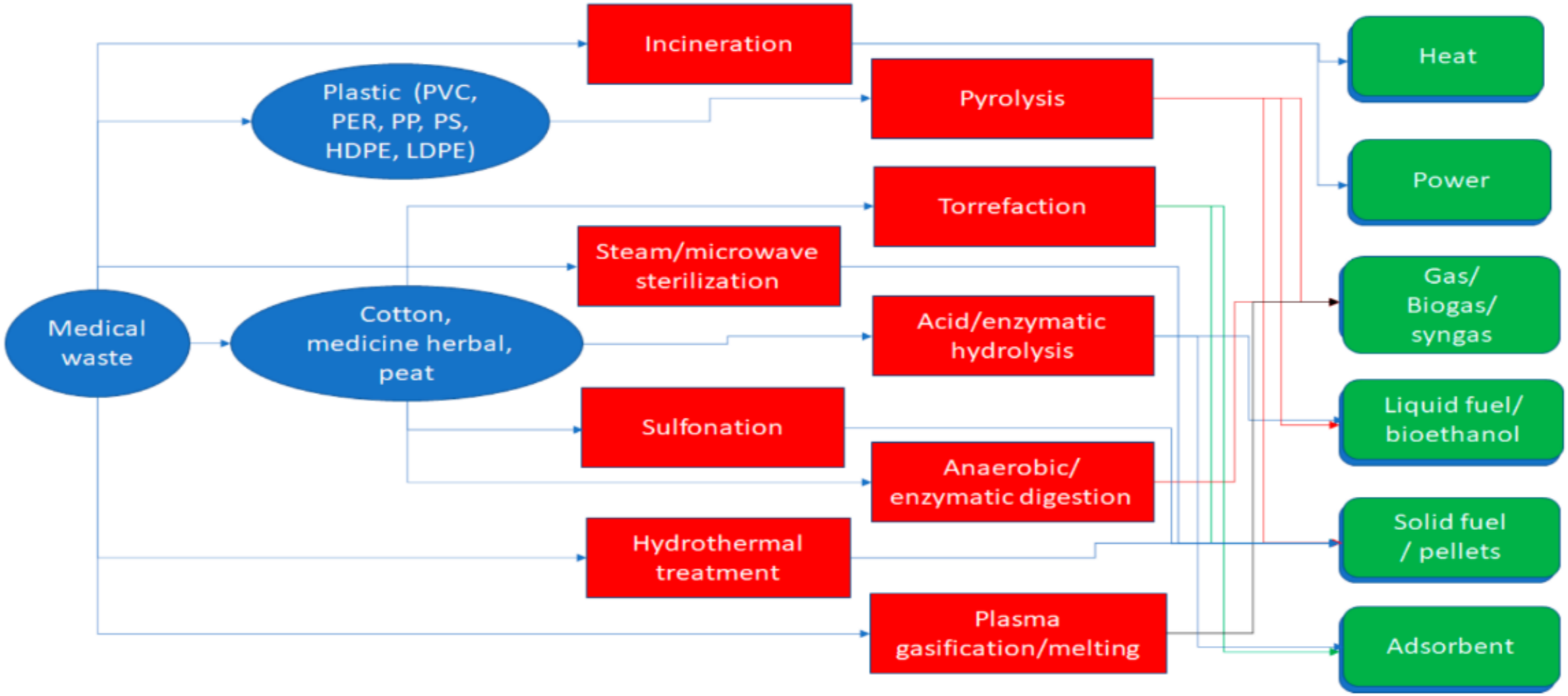


Table 3.2.7.9: Types of PPE and requirements of safe handling & treatment

Types of PPE	Types of Wastes	Required safe handling and treatment
Mask, Gloves and Gown	Infectious	Yes
SARS-CoV-2 rapid antigen test	Non-hazardous	Most components are recyclable; a very small volume of reagent may require safe handling and disposal if dealing with large numbers of tests.
PCR testing cartridge	Chemical	Yes (contains guanidinium thiocyanate)
Vaccine Vial	Non-Hazardous	No
Vaccine needle	Sharp	Yes (packaging material is recyclable)
Plastic packing and containers	Non-Hazardous	No

3.2.7.4. Conclusion and Way Forward

The recycling services segment value was pegged at around US$350 million in 2019, a robust growth is projected in the next five years. Asia Pacific Medical Waste Management will have a potential of a huge market size for both Hazardous and Non-hazardous type for Collection, Transportation & Storage Services, Treatment and Disposable Services, e.g., Incineration, Autoclaving, Microwaving, Recycling services for the Waste Generators, e.g., Hospitals, Laboratories and Research Centres, Nursing Homes.

On the Post Hanoi declaration, in the 5th Regional 3R Forum for Asia and the Pacific a core set of nine 3R policy indicators were finalized [1] as:

1. Per capita total municipal solid waste (MSW) generation and disposal. – **Improved a lot**
2. Recycling of individual components of MSW and overall recycling rate (%). **– In HCW, huge gap exists, in most of the developing countries**
3. Proper classification and inventory of hazardous waste developed. **– In HCW, huge gap exists, in most of the developing countries**
4. Indicators based on macro-level material flows.
5. Amount of agricultural biomass and livestock waste recycled.
6. Marine and coastal plastic waste management plans and regional initiatives initiated. **–HCW has greater impact on this in most of the developing countries**
7. Generation of e-waste, their disposal and recycling. Guidelines for environmentally sound e-waste management focusing occupational safety and health standards.
8. New EPR policies enacted or existing policies and guidelines strengthened. **– may be considered to extent to the plastic part of HCW**
9. Greenhouse Gas (GHG) emissions from waste sector and possible routes for minimization. **– should be considered**

Forward Planning

The Ha Noi 3R Declaration is due to expire in 2023. It is now necessary to align the new goals with the targets within SDGs that are relevant to healthcare waste. Success in healthcare waste management will speed progress towards meeting several of the UN Sustainable Development Goals, particularly:

Goal 3: Good health and wellbeing,

Goal 5: Enforce Gender Equality

Goal 6: Clean water and sanitation,

Goal 8: Decent work and economic growth

Goal 9: Increase Industry, Innovation and Infrastructure

Goal 11. Mobilize Sustainable Cities and Communities

Goal 12: Responsible consumption and production and

Goal 13: Climate action

Goal 14. Life Below Water

Consideration in the Post Ha Noi 3R Declaration beyond 2023.

- ❑ Establish and strengthen the implementation of HCW Rules and policies in the countries
- ❑ Reduction of HCW by application of technological advancement
- ❑ Recycle of HCW and proper use of recycled products with necessary restrictions
- ❑ Awareness generation on HCW segregation, storage, ill effects and treatment (COVID & Non-COVID)
- ❑ Reduce the leakage of HCW in water bodies including marine environment
- ❑ Restriction/enforcement on transboundary movement & illegal disposal/reuse/recycle
- ❑ Innovation and Infrastructure development in HCW management and Recycling
- ❑ Centralised and decentralised HCW treatment with non-burning technologies.
- ❑ encourage and strengthen research & development and innovation
- ❑ Social , health Security including insurance for the HCW handlers & Formalisation

Thank you