Blue Planet
Environmental Solutions

BIOMINING

AGGREGATES-
TESTING.APPLICATION.
TRACEABILITY & UPCYCLING

ZIGMA
alchemists of the msw

APPLICATIONS OF AGGREGATES GENERATED FROM BIO-MINING PROCESS

When legacy waste vide Bio-mining process is segregated, predominantly the following aggregates are generated, namely (a) Fine Soil (b)Coarse Soil (c)Stones (d)Combustibles and (e)Recyclables. The aggregates thus generated are used for various application based on their characteristics and in accordance with the CPCB Guidelines for Disposal of Legacy Waste 2019.

A pictorial representation of the same is as mentioned below:

Let us now understand the applications of each of the aggregates in detail:

Fine Soil

Fine soil is the finest fraction of the aggregates generally less than 8mm in size and has excellent moisture retention capacity. This fraction is generally called bio-earth or good earth and contains a mixture of humus-rich organics which improve soil fertility along with a high proportion of soil or sand, which is why it cannot meet FCO standards for compost for edible crops. ***The Fine soil is tested for all the parameter like pH, Conductivity as per SWM rules 2016 (compost standards) and also for its ability to leach (TCLP/STLC test) before its end use.***

Since it contains humus rich organics, the recovered earthy fines shall preferably be used for landscaping or gardening or road medians within the jurisdiction of the Local Body or the site. The recovered soil can also be used as “Soil enricher” to develop green areas. They can be used as soil improver due to the presence of Organic carbon, especially for restoring alkaline or saline soils to fertility, or to grow some vegetation for erosion control. It is also useful as a lawn subgrade cum drainage layer, or it can be used as organic manure in tree pits. Further, it must be ensured that this fraction is not sold as compost and used for edible crops.

Ideally they can be used in afforestation and forest nurseries as their requirements are typically huge.

Inert Coarse Soil and Stones

This fraction which is generally above 8mm and contains coarser soil along with stones can be used for filing low lying areas for land reclamation. It can also be used in applications like building roads, road embankments, railway embankments among others. ***The Coarse soil and stones are tested for all the parameters like pH, Conductivity & also for its ability to leach (TCLP/STLC test) before its end use.***

It is very important however to carry out tests as mentioned in the CPCB Guidelines for Disposal of legacy waste, 2019 and as mentioned below before the same is being used offsite to ensure that they are inert and do not leach out.

Combustibles / RDF

This fraction consists of all combustible fractions including non-recyclable plastics, multi-layer plastics, footwear, leather items, and textiles among others. Since these materials has a calorific value more that 2600- 3200 Kcal/Kg it can be further processed to be used a Refuse Derived Fuel (RDF). Further process would require screening to reduce ash, decrease moisture and reduce size.

As per CPCB Guidelines for Disposal of legacy waste, 2019, the RDF can be used by co-processing facilities in cement kilns and waste to energy plants. If this needs to be used in any other industry like boiler, bio-mass power plants, thermal power plants etc. the specific industry must obtain a Consent to Operate with RDF to be mentioned as a kind of fuel without which the same would be deemed as unscientific disposal.

Recyclables

The materials like glass bottles, metals, hard plastics among others which are segregated from the process as predominantly recyclable in nature and is channelized through traders or industries for recycling.

LIST OF TESTS TO BE CONDUCTED.

It is very important that before the aggregates are disposed, they must be tested for various parameters as mentioned in the CPCB Guidelines for Disposal of Legacy Waste 2019 and SWM Rules 2016. This is required to be conducted at various intervals as per the guidelines using ***internal and external*** laboratories.

Internal testing - Tests to be conducted within the site.

The basic parameters are tested at the lab facility available at site to determine the quality of the output soil and RDF. The aggregates are constantly monitored to maintain the quality of the output and sample are collected and prepared through quartering and coning method for analysis.

RDF

List of parameters for RDF

S.No	Parameters	Internal KPI	Frequency of testing
1	Moisture content (%)	<35	Daily
2	Ash content (%)	<20	
3	Soil (%)	-	

Inert Soil and C&D

List of parameters for Soil and C&D

S.No	Parameters	Internal KPI	Frequency of testing
1	Moisture content (%)	<30	Daily
2	pH	6.5 – 8.5	
3	Conductivity (dS/m)	<4	

4	TDS (ppm)	-	
5	Salinity (ppm)	-	
6	Sieve analysis (%)	<5	

Sieve analysis

Sieve analysis is conducted to determine the quality of in the inert soil and stones output segregated from the waste. The output might contain various other fractions mixed with them like glass, plastic, etc.,. The percentage of other fractions mixed with soil and stones are determined by the sieve analysis. CPCB guidelines on Disposal of legacy waste, 2019 mentions the inert should not contain 3-5% of plastics by weight to be fit for disposal.

External Testing - List of test conducted by external labs

Fine Soil, Coarse Soil and C&D

The external monitoring and analysis is done by NABL accredited labs periodically, usually on a monthly basis. ***The Fine soil, Coarse soil and Stones are analyzed for the parameters as per SWM Rules 2016 and also for the leachability (TCLP) tests as per CPCB guidelines for Disposal of legacy waste, 2019, to ensure the heavy metals (if any) will not leach out during the offsite/onsite disposal.*** The parameters are mentioned below.

List of parameters as per SWM Rules, 2016

Parameters	**Organic Compost (FCO 2009)**	**Phosphate Rich Organic Manure (FCO 2013)**
Arsenic (mg/kg)	10	10
Cadmium (mg/kg)	5	5
Chromium (mg/kg)	50	50
Copper (mg/kg)	300	300
Lead (mg/kg)	100	100
Mercury (mg/kg)	0.15	0.15
Nickel (mg/kg)	50	50
Zinc (mg/kg)	1000	1000
C/N ratio	<20	Less than 20:1
pH	6.5-7.5	(1:5 solution) maximum 6.7
Total Organic Carbon, per cent by weight, minimum	12	7.9
Total Nitrogen (as N), per cent by weight, minimum	0.8	0.4

Total Phosphate (as P_2O_5) percent by weight, minimum	0.4	10.4
Total Potassium (as K_2)), percent by weight, minimum	0.4	-
Conductivity (as dsm^{-1}), not more than	4	8.2

List of parameters tested for leachability (TCLP/STLC)

S.No	Parameters	Permissible limit as per HWM 2016 (Concentration in mg/l) or USEPA standards
1	Arsenic as As	5
2	Cadmium as Cd	1
3	Total Chromium as Cr	5
4	Lead as Pb	5
5	Mercury as Hg	0.2
6	Copper as Cu	25
7	Zinc as Zn	250
8	Nickel as Ni	20

RDF

RDF quality is analyzed before it's been sent to the Cement plants where it is used as an alternate fuel. The quality parameters for which the RDF is tested is as mentioned below, having said this, the cement plants will test the RDF quality (random samples) as per their Quality Testing procedure. The test procedure and parameters may vary from one cement factory to other.

List of parameters for RDF

S.No	Parameters	Permissible limit as per guidelines on usage of refuse derived fuel in various industries (SCF grade)
1	Moisture content (%)	<35
2	Ash content (%)	<20
3	Fixed carbon (%)	-
4	Volatile matter (%)	-
5	Calorific value (Kcal/Kg)	>1500

TRACEABILITY OF THE DISPOSED FRACTIONS:

As a part of the last mile reporting, it must be ensured that the Urban and Local Bodies who are the client will obtain the following documents pertaining to the disposal of aggregates generated from the process.

Combustible Fraction/RDF:

Co-processing certificate from the industry/organization on their letterhead, where such fractions will be channelized, to be obtained for the quantity of RDF they have used for co-processing. The Certificates must have unique Reference Numbers and contact numbers of person/s to whom the client can talk for verification of its originality. The certificates should also mention their GST Number and full address. A copy of NOC taken by the industry/organization from the State Pollution Control Board may also be obtained.

In all the cases, weigh bridge slips may be kept in original for verification throughout the contract period.

Recyclables:

Proper certificates/documents for the channelization of the recyclables to the recyclers have to be obtained. The certificates must be on their letterhead, mentioning their GST Number, and full address with contact number. A copy of registration taken by the recyclers from the respective ULB/SPCB may be obtained to ensure that they are genuine recyclers. Copy of past record of 3 years operations may also be collected from the recycler, such as ITR, production details, sales record, etc.

In case of supplying to the traders, the following documents may be obtained:

- Any internal document from the company registering the sale like Invoice/ Delivery Challan which essentially mentions the name of the commodity, quantity, date etc.
- A photograph of the material loaded over the vehicle clearly showing the vehicle and it has to match the Vehicle number mentioned in the Invoice. The photograph taken must have the date marked on the same.
- In all the cases, weigh bridge slips may be kept in original for verification throughout the contract period.

Soil Enricher:

The Soil Enricher may be used for the following applications, like Agro forestry, Afforestation, Parks or any other application barring non-food based crops. In case the land for the disposal belongs to the government departments (like NHAI, Forest department, Public Works Department, Municipal Corporation, etc.) then the contractor shall produce:

- An acceptance letter from the department on the quantity in truck loads/ Metric tons clearly mentioning the application for which it is used.
- A before and after picture of the site where the same has been used may be obtained by the contractor with the dates marked on the same

In case the land belongs to a private person/company, then:

- The contractor needs to sign a NOC with the landowner that he understands the soil has to be used for the specific purpose.
- Contactor also has to obtain some proof showing that the land belongs to the said landlord or the person to whom the same is supplied has an understanding the original landlord for using the material for the specific purpose.
- A before and after picture of the site where the same has been used may be obtained by the contractor with the dates marked on the same.

In all cases, the material must be tested for TCLP tests and a copy of the same may be provided to the client whenever asked for.

Inert Soil/ C&D material:

The inert stones generated from the process need to be used for Filling up low lying areas, mining quarries. In case the low-lying areas where the stones are being filled up belongs to the government departments then the contractor need to produce:

- An acceptance letter from the department may be obtained on the quantity in truck loads/ Metric Tons clearly mentioning the application for which it is used.
- A before and after picture of the site where the same has been used may be obtained by the contractor with the dates marked on the same.

In case the land belongs to a private person/company, then:

- The contractor needs to sign a NOC with the landowner that he understands the stones must be used for the specific purpose.
- Contractor also must obtain some proof showing that the land belongs to the said landlord or the person to whom the same is supplied has an understanding the original landlord for using the material for the specific purpose.
- Contractor also must obtain a letter mentioning the number of truck loads/Metric Tons that has been dumped in the said site once the site is filled up.
- A before and after picture of the site where the same has been used may be obtained by the contractor with the dates marked on the same.

In case the Contractor plans to supply such fraction to the C&D processing facilities for further applications of reuse and recycling, then utilization certificate on the quantities taken on quarterly basis needs to be produced as supporting document.

In all cases, the material must be tested for TCLP tests and a copy of the same may be provided to the client whenever asked for.

UPCYCLING OF AGGREGATES OBTAINED FROM BIOMINING

(i) Up cycling of Soil- Sand washing process:

Through ongoing research and development efforts, Zigma has created its own sand washing unit with the goal of enhancing the quality of soil obtained from Landfill Mining. The unit is designed to eliminate impurities, reduce slit, thus enhancing the strength of sand during the washing process, resulting in elimination of odour and colour from the Landfill-mined soil. Zigma's in-house designed sand washing plant features a zero discharge washing line, dewatering unit and a unit for reprocessing wash water, among other components. The washing tank is equipped with high-pressure to separate impurities from soil.

Input Soil -18mm

Output Washed Soil -6mm

The washed sand meets the IS: 383-2016 standard, which makes it appropriate for use in construction applications. Additionally, the washed sand is comparably low in organic impurities, Chloride and sulphate. Overall, the Sand washing process for Biomining is an effective method for enhancing sand quality, thus rendering it ideal for construction applications. The test reports for the same are attached herewith.

Usage of washed sand from Landfill mined soil as a substitute for primary raw materials also supports sustainability efforts by reducing the need for resource-intensive mining activities thus aligning with the principles of circularity and sustainability.

Test reports for washed sand obtained from the sand washing process

MINERVA CIVIL TESTING LAB PRIVATE LTD

TEST REPORT

Report No.: **R2304029-02** Ref. No.: **NIL** Date: **13-04-2023**

CUSTOMER DETAILS			
Customer Name & Address	**M/S Zigma Global Environ Solutions Pvt Ltd,** 24, Kalaimagal Kalvi Nilayam Road Erode - 638001		
Project	Perungudi Package 5 Washed Soil		
Customer Reference	Test request dated on 12/04/2023		
SAMPLE DETAILS			
Sample Code	J2304021-03	**Sample Received**	11-04-2023
Sample Description*	Washed Sample - 6mm	**Test Procedure**	IS: 2386 (Part I to VIII)-1963 (Reaff – 2016) and IS: 383-2016
Test started on	12-04-2023	**Test finished on**	13-04-2023

Physical and Chemical Test Results for Sand

Sl. No.	Physical & Chemical Parameters	Limits as per IS 383:2016(RA)		Results
		Min.	Max.	
1	Moisture Content in %	-	-	**8.10**
2	Bulking Percentage at 5% water Content in %	-	-	**14**
3	Loose Bulk Density in g/cc	-	-	**1.41**
4	Rodded Bulk Density in g/cc	-	-	**1.56**
5	Specific Gravity at 27° C (No unit)	2.1	3.2	**2.57**
6	Water Absorption in %	-	5	**1.59**
7	Organic Impurities	-	Do not present	**Nil**
8	Water Soluble Cholride in %	-	0.04	**Nil**
9	Sulphate Content as SO3 in %	-	0.5	**Nil**

Terms & Conditions:

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2 Samples as supplied by the client.
3 Any clarifications / complaints of the report should be made in writing within 2 days from the date of test report.
4 Unless informed by the client the samples will not be retained for more than 7 days from the date of issue of this

*** *End of Test Report* ***

Authorized Signatory

R. Sharvesh 13/4/23

R. SHARVESH M.E

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Test reports for washed sand obtained from the sand washing process

MINERVA CIVIL TESTING LAB PRIVATE LTD

TEST REPORT

Report No.: **R2304029-01** Ref. No.: **NIL** Date: **13-04-2023**

CUSTOMER DETAILS			
Customer Name & Address	**M/S Zigma Global Environ Solutions Pvt Ltd,** 24, Kalaimagal Kalvi Nilayam Road Erode - 638001		
Project	Perungudi Package 5 Washed Soil		
Customer Reference	Test request dated on 12/04/2023		
SAMPLE DETAILS			
Sample Code	J2304021-02	**Sample Received on**	11-04-2023
Sample Description*	Washed Sample - 6mm	**Test Procedure**	IS: 2386 (Part I to VIII)-1963 (Reaff – 2016) and IS: 383-2016
Test started on	12-04-2023	**Test finished on**	13-04-2023

TEST RESULTS OF SAND FOR REINFORCED CONCRETE

Sl. No.	Test Carried	IS Sieve Designation	Specification as per IS:383-2016 for Fine Aggregate (Percentage Passing)				Cumulative Percent (%)	
			Zone-I	Zone-II	Zone-III	Zone-IV	Retained	Passing
1	SIEVE ANALYSIS	10 mm	100	100	**100**	100	0.00	**100.00**
		4.75 mm	90-100	90-100	**90-100**	95-100	0.00	**100.00**
		2.36 mm	60-95	75-100	**85-100**	95-100	2.59	**97.41**
		1.18 mm	30-70	55-90	**75-90**	90-100	16.17	**83.83**
		600 microns	15-34	35-59	**60-79**	80-100	33.53	**66.47**
		300 microns	5-20	8-30	**12-40**	15-50	68.36	**31.64**
		150 microns	0-20	0-20	**0-20**	0-20	91.52	**8.48**

Remarks: *The given Sand* ***Satisfies with the Zone - III grading*** *specifications of IS: 383-2016 to be used for Reinforced Concrete*

2	Silt Content by Volume	%	**1.18**	IS:2386(Part II-1963)	--
3	**Deletorious material**				
	a) Clay Lumps	%	**0.03**	IS:2386(Part II-1963)	Max 1% by wt
	b) Materials Finer than 75 µ	%	**2.71**		for Natural/ Blended Sand Max 3% by wt., for Crushed Sand max 15% by wt.

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*** *End of Test Report* ***

Authorized Signatory
R. Sharvesh 13/4/23
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Quality is Pride of Workmanship!

Photograph of Zigma's Sand washing unit at one of the Biomining Facilities

(ii) Up cycling of RDF

Zigma has developed an in-house process for converting low-value plastics, multi-layered plastics, and non-recyclable post-consumer plastics, including Refuse-Derived Fuel (RDF), into recycled sheets. These recycled sheets can be further utilized to manufacture value-added products such as shuttering boards, coasters, plastic benches, and more. This initiative is promising, as it effectively addresses the challenges associated with recycling diverse types of plastics that are typically hard to recycle. The photographs & test reports below represent the some of the products up cycled from landfill RDF.

TEST RESULTS OF ZIGMA GLOBAL ENVIRON SOLUTIONS

S.NO	Properties	Standards	Unit	Result	Accreditations From
1	RoHS	Directive 2011/65/EU	-	PASS	SGS
2	Calorific Value	ASTM D240	Kcal/Kg	13410	ATMY
3	Thermal Conductivity	ASTM C117	w/mk	0.18	ATMY
4	Melt Flow Index	ASTM D1238	g/10min	2.19	ATMY
5	Charpy Impact Strength	ISO 179	Kj/m^2	24	ATMY
6	Tensile Strength	ASTM D638	Mpa	12.69	ATMY
7	Flexural Modulus	ASTM D790	Mpa	256.05	ATMY
8	Limiting Oxygen Index (LOI)	ASTM D2863	%	34	ATMY
9	Co-efficient of Linear Thermal Expansion	ASTM D696	1/◦C	3.28×10^-5	ATMY

TEST REPORT

Report No. : CH:TR:1357000056 **DATE : 27/01/2022**

ZIGMA GLOBAL ENVIRON SOLUTIONS PRIVATE LIMITED
24, KALAIMAGAL KALVI NILAYAM ROAD
Tamil Nadu, Erode-638001
IN
CONTACT PERSON : Mr Rajavenkadesh R K

THE FOLLOWING SAMPLE(S) WAS/WERE SUBMITTED AND IDENTIFIED BY/ON BEHALF OF THE CUSTOMER AS :

SAMPLE DESCRIPTION SAMPLE_Recycled Plastic
OEM **OEM-OTHERS**
COUNTRY OF DESTINATION INDIA
COUNTRY OF ORIGIN INDIA
SAMPLE RECD ON 05-Jan-2022 **TESTING PERIOD :** 05/01/2022 - 27/01/2022

TESTS	CONCLUSION	REMARKS
ROHS Test- Polymer	PASS	

Conclusion : Based on the performed tests on selected part of submitted samples, the results of Lead, Mercury, Cadmium, Hexavalent chromium, Polybrominated biphenyls (PBB), Polybrominated diphenyl ethers (PBDE) and Phthalates such as Bis(2-ethylhexyl) phthalate (DEHP), Butyl benzyl phthalate (BBP), Dibutyl phthalate (DBP) and Diisobutyl phthalate (DIBP) comply with the limits as set by Directive (EU) 2015/863 amending Annex II to Directive 2011/65/EU.

per pro SGS India Private Ltd.

S. PURUSHOTAMAN

ASST. MANAGER

Email your Test Report Related Enquiries at Feedback.TRP@sgs.com

SGS India Pvt. Ltd. **Transportation Laboratory, Connectivity and Products Testing Laboratory, 28 B/1 (SP),28 B/2 (SP),Second Main Road, Ambattur Industrial Estate ,Ambattur,Chennai-600 058. Phone:91-44-66081600, Fax:91-44-66081700**

TEST REPORT

Report No. : CH:TR:1357000056 **DATE : 27/01/2022**

ROHS Test- Polymer

Test Method :

RoHS Directive (EU) 2015/863 amending Annex II to Directive 2011/65/EU
Test Method:
(1) With reference to IEC 62321-5:2013, determination of Cadmium by ICP-OES.
(2) With reference to IEC 62321-5:2013, determination of Lead by ICP-OES.
(3) With reference to IEC 62321-4:2013 +A1:2017, determination of Mercury by ICP-OES.
(4) With reference to IEC 62321-7-1:2017 / EPA 3052, determination of Hexavalent Chromium in colorless and colored corrosion- protected coatings on metals by the colorimetric method.
(5) With reference to IEC 62321-7-2:2017 / EPA 3052, determination of Hexavalent Chromium by Colorimetric Method using UV-Vis and/or with reference to IEC 62321-5:2013, determination of Chromium by ICP-OES..
(6) With reference to IEC 62321-6:2015, determination of PBBs and PBDEs by GC-MS.
(7) With reference to IEC 62321-8:2017, determination of phthalates by GC-MS, phthalates by GC-MS.

Item Name :	Unit	Results	MDL	Acceptance Criteria / Limit
Lead (Pb)	mg/kg	n.d	5	1000
Cadmium(Cd)	mg/kg	n.d	5	100
Mercury (Hg)	mg/kg	n.d	5	1000
Hexavalent Chromium (Cr(VI))	mg/kg	n.d	8	1000
Sum of PBBs				1000
Monobromobiphenyl	mg/kg	n.d	50	--
Dibromobiphenyl	mg/kg	n.d	50	--
Tribromobiphenyl	mg/kg	n.d	50	--
Tetrabromobiphenyl	mg/kg	n.d	50	--
Hexabromobiphenyl	mg/kg	n.d	50	--
Pentabromobiphenyl	mg/kg	n.d	50	--
Heptabromobiphenyl	mg/kg	n.d	50	--
Octabromobiphenyl	mg/kg	n.d	50	--
Nonabromobiphenyl	mg/kg	n.d	50	--
Decabromobiphenyl	mg/kg	n.d	50	--
Sum of PBDEs				1000
Monobromodiphenyl ether	mg/kg	n.d	50	--
Dibromodiphenyl ether	mg/kg	n.d	50	--
Tribromodiphenyl ether	mg/kg	n.d	50	--

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Member of the SGS Group (SGS SA)

Tetrabromodiphenyl ether	mg/kg	n.d	50	--
Pentabromodiphenyl ether	mg/kg	n.d	50	--
Hexabromodiphenyl ether	mg/kg	n.d	50	--
Heptabromodiphenyl ether	mg/kg	n.d	50	--
Octabromodiphenyl ether	mg/kg	n.d	50	--
Nonabromodiphenyl ether	mg/kg	n.d	50	--
Decabromodiphenyl ether	mg/kg	n.d	50	--
Dibutyl phthalate (DBP)	mg/kg	n.d	100	1000
Butyl benzyl phthalate (BBP)	mg/kg	n.d	100	1000
Bis (2-ethylhexyl) phthalate (DEHP)	mg/kg	n.d	100	1000
Diisobutyl Phthalates (DIBP)	mg/kg	n.d	100	1000

Remarks:

(1) 1mg/kg=0.0001%
(2) MDL = Method Detection Limit
(3) n.d = not detected (<MDL)

Note :

(1) The maximum permissible limit is quoted from RoHS Directive (EU) 2015/863.
IEC 62321 series is equivalent to EN 62321 series
http://www.cenelec.eu/dyn/www/f?p=104:30:1742232870351101::::FSP_ORG_ID,FSP_LANG_ID:1258637,25
(2) Test has been performed on composite parts as per client's request
(3) The result of Hexavalent Chromium (Cr(VI)) is "ND" as the result of Chromium (Cr) is "ND", and confirmation test of Hexavalent Chromium (Cr(VI)) is not required.
(4) If the Chromium (Cr) content is greater than the MDL of of Hexavalent Chromium (Cr(VI)), confirmation test of Hexavalent Chromium (Cr(VI)) is required.
(5) On 4 June 2015, Commission Directive (EU) 2015/863 was published in the Official Journal of the European Union (OJEU) to include the phthalates BBP, DBP, DEHP and DIBP into ANNEX II of the Rohs Recast Directive. The new law
restricts each phthalate to no more than 0.1% in each homogeneous material of an electrical product.
(6) The restriction of DEHP, BBP, DBP and DIBP shall apply to medical devices, including in vitro medical devices, and monitoring and control instruments, including industrial monitoring and control instruments, from 22 July 2021.
(7) The restriction of DEHP, BBP, DBP and DIBP shall not apply to cables or spare parts for the repair, the reuse, the updating of functionalities or upgrading of capacity of EEE placed on the market before 22 July 2019, and of medical devices,
including in vitro medical devices, and monitoring and control instruments, including industrial monitoring and control instruments, placed on the market before 22 July 2021.
(8) The restriction of DEHP, BBP and DBP shall not apply to toys which are already subject to the restriction of DEHP, BBP and DBP through entry 51 of Annex XVII to Regulation (EC) No 1907/2006.
(9) Above test is subcontracted to SGS Pune Lab.

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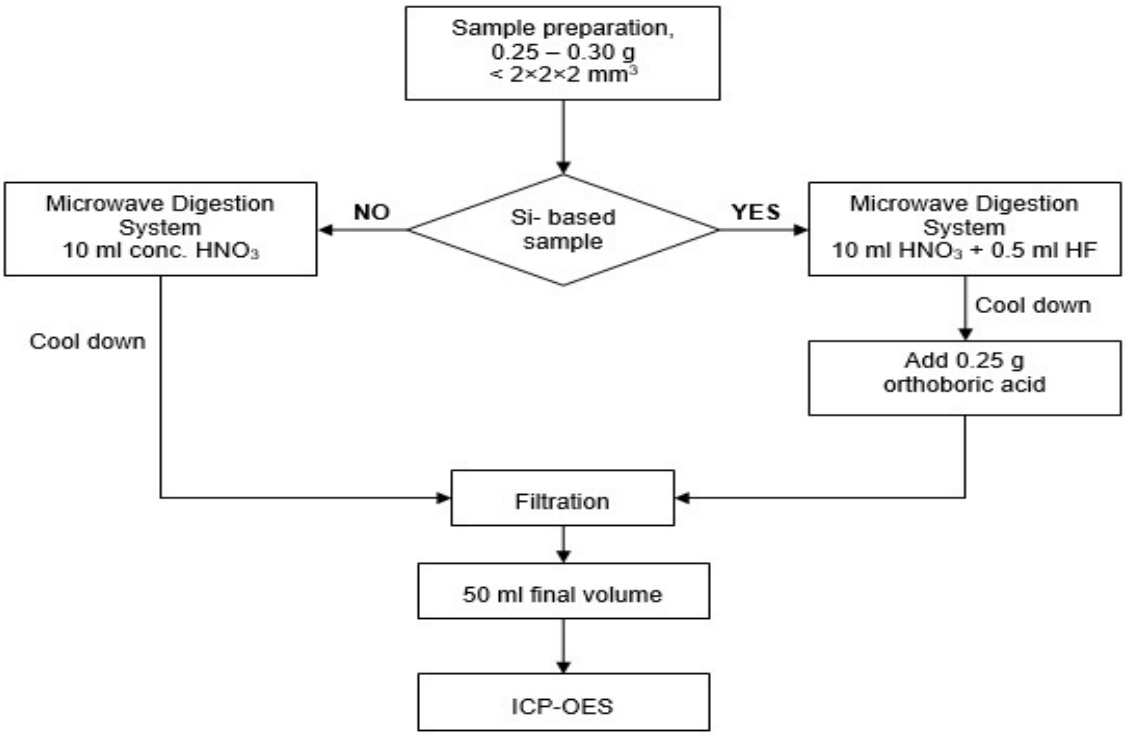
TEST REPORT

Report No. : CH:TR:1357000056 **DATE : 27/01/2022**

Process Flow for analysis of metal contents in plastics, metals and electronic components sample



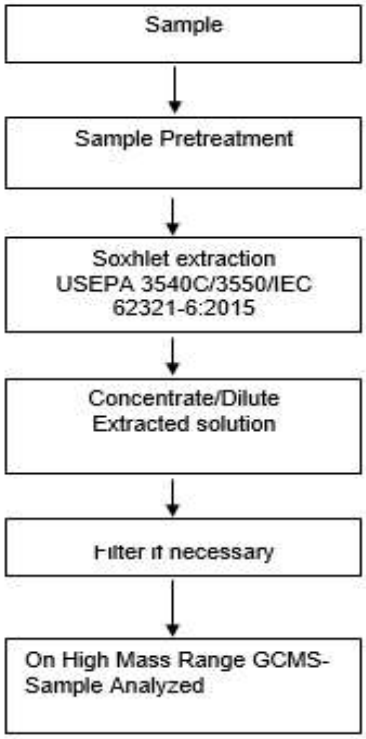
Analyzed By : Jyoti Nakate **Checked By :** Swaroop Kulkarni

SGS India Pvt. Ltd. **Transportation Laboratory, Connectivity and Products Testing Laboratory, 28 B/1 (SP),28 B/2 (SP),Second Main Road, Ambattur Industrial Estate ,Ambattur,Chennai-600 058. Phone:91-44-66081600, Fax:91-44-66081700**

TEST REPORT

Report No. : CH:TR:1357000056 **DATE : 27/01/2022**

Process Flow for analysis of Flame Retardants in plastics, metals and electronic components sample



Analyzed By : Ashwini Sagar **Checked By :** Sachin Vibhute

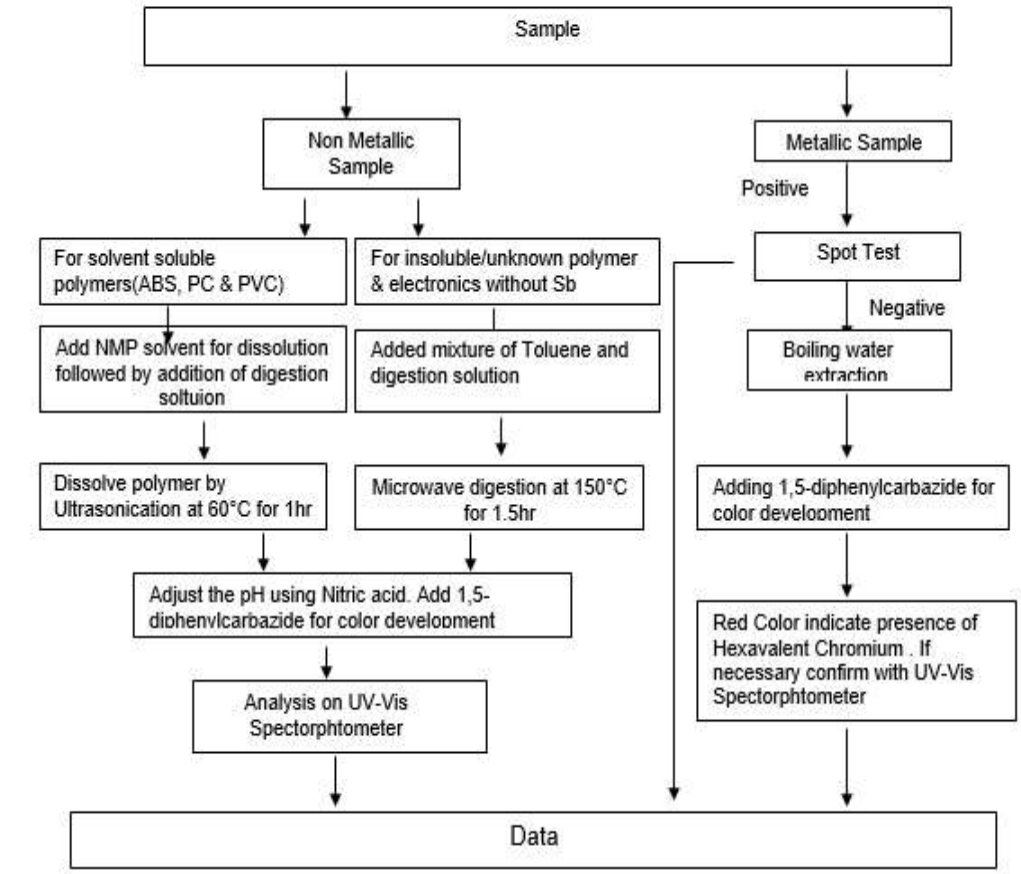
SGS India Pvt. Ltd. **Transportation Laboratory, Connectivity and Products Testing Laboratory, 28 B/1 (SP),28 B/2 (SP),Second Main Road, Ambattur Industrial Estate ,Ambattur,Chennai-600 058. Phone:91-44-66081600, Fax:91-44-66081700**

Member of the SGS Group (SGS SA)

TEST REPORT

Report No. : CH:TR:1357000056 **DATE : 27/01/2022**

Process Flow for analysis of Hexavalent Chromium contents in plastics, metals and electronic components sample



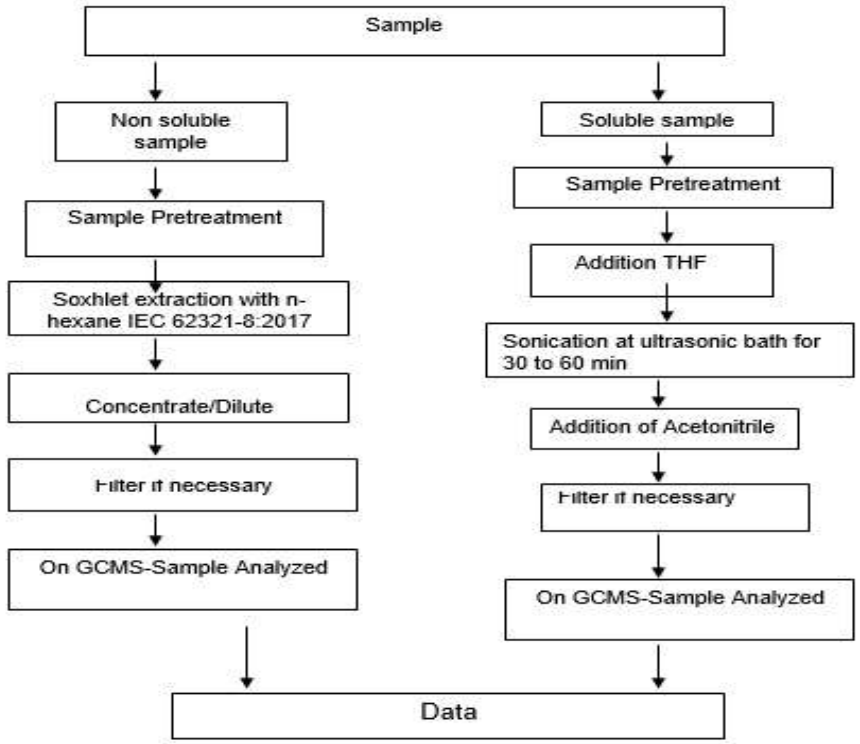
Analyzed By : Jyoti Nakate **Checked By :** Swaroop Kulkarni

SGS India Pvt. Ltd. **Transportation Laboratory, Connectivity and Products Testing Laboratory, 28 B/1 (SP),28 B/2 (SP),Second Main Road, Ambattur Industrial Estate ,Ambattur,Chennai-600 058. Phone:91-44-66081600, Fax:91-44-66081700**

TEST REPORT

Report No. : CH:TR:1357000056 **DATE : 27/01/2022**

Process Flow for analysis of Phthalates in Electrotechnical Product As per soxhelt Extraction or THE Extraction:



Analyzed By : Ashwini Sagar **Checked By :** Sachin Vibhute

SGS India Pvt. Ltd. **Transportation Laboratory, Connectivity and Products Testing Laboratory, 28 B/1 (SP),28 B/2 (SP),Second Main Road, Ambattur Industrial Estate ,Ambattur,Chennai-600 058. Phone:91-44-66081600, Fax:91-44-66081700**

TEST REPORT

Report No. : CH:TR:1357000056 **DATE : 27/01/2022**

SAMPLE AS RECEIVED

***** End of Report ****

SGS India Pvt. Ltd. **Transportation Laboratory, Connectivity and Products Testing Laboratory, 28 B/1 (SP),28 B/2 (SP),Second Main Road, Ambattur Industrial Estate ,Ambattur,Chennai-600 058. Phone:91-44-66081600, Fax:91-44-66081700**

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TEST REPORT

Report No.: **2201100063**

Date: 13-01-2022

Issued To:

M/s ZIGMA GLOBAL ENVIRON SOLUTIONS PVT. LTD.
24, KALAIMAGAL KALVI NILAYAM RD, KAIKOLAR THOTTAM,
CHIDAMBARAM COLONY, ERODE, TAMILNADU - 638001

Sample Description	:	RECYCLED PLASTIC GRANULES
Sample Received Date	:	10-01-2022
Sample Drawn By	:	Client
Specification	:	--
Test Requested	:	GROSS CALORIFIC VALUE (GCV)
Test Method	:	Refer to Attached Pages.
Test Result	:	Refer to Attached Pages.

SAMPLE PICTURE

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TEST REPORT

Report No.: **2201100063**

Date: 13-01-2022

I. GCV

1. Plastic and Resin

GROSS CALORIFIC VALUE (GCV) **Test performed on : 12-01-2022 to 13-01-2022**

Test Method : IS 1350, Part-2:2013

Test Parameter	Result
Gross calorific value, kcal/kg	13410

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Prince Rajput
SR. ANALYST

Authorised Signatory

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TEST REPORT

Report No.: **2201100069**

Date: 21-01-2022

Issued To:

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CHIDAMBARAM COLONY, ERODE, TAMILNADU - 638001

Sample Description	:	RECYCLED PLASTIC LUMBAR
Sample Received Date	:	10-01-2022
Sample Drawn By	:	Client
Specification	:	--
Test Requested	:	THERMAL CONDUCTIVITY
Test Method	:	Refer to Attached Pages.
Test Result	:	Refer to Attached Pages.

SAMPLE PICTURE

Terms & Conditions:-

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TEST REPORT

Report No.: **2201100069**

Date: 21-01-2022

I. Physical

1.

THERMAL CONDUCTIVITY TEST **Test performed on : 17-01-2022 to 21-01-2022**

Test Parameter	Unit	Result	Test Method
Thermal Conductivity	w/mk	0.18	ASTM C117

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Vishal Singh Tomar
ANALYST

Authorised Signatory

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TEST REPORT

Report No.: **2201100064**

Date: 12-01-2022

Issued To:

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24, KALAIMAGAL KALVI NILAYAM RD, KAIKOLAR THOTTAM,
CHIDAMBARAM COLONY, ERODE, TAMILNADU - 638001

Sample Description	:	RECYCLED PLASTIC GRANULES
Sample Received Date	:	10-01-2022
Sample Drawn By	:	Client
Specification	:	--
Test Requested	:	Melt Flow Index
Test Method	:	Refer to Attached Pages.
Test Result	:	Refer to Attached Pages.

SAMPLE PICTURE

Terms & Conditions:-

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TEST REPORT

Report No.: **2201100064**

Date: 12-01-2022

I. Mechanical

1. Plastics & Resins

Melt Flow Index **Test performed on : 10-01-2022 to 12-01-2022**

Test Method : ASTM D 1238:2013

Test Parameter	Result
Melt Flow Index (g/10min) (at 190°C/ 5 kg load)	2.19

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Vishal Singh Tomar
ANALYST

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TEST REPORT

Report No.: **2201100065**

Date: 21-01-2022

Issued To:

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CHIDAMBARAM COLONY, ERODE, TAMILNADU - 638001

Sample Description	:	RECYCLED PLASTIC LUMBAR
Sample Received Date	:	10-01-2022
Sample Drawn By	:	Client
Specification	:	--
Test Requested	:	CHARPY IMPACT STRENGTH
Test Method	:	Refer to Attached Pages.
Test Result	:	Refer to Attached Pages.

SAMPLE PICTURE

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TEST REPORT

Report No.: **2201100065**

Date: 21-01-2022

I. Mechanical

1.

CHARPY IMPACT STRENGTH **Test performed on : 17-01-2022 to 21-01-2022**

Test Parameter	Unit	Result	Test Method
Charpy Impact Strength	Kj/m²	24.0	ISO 179

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Vishal Singh Tomar
ANALYST

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TEST REPORT

Report No.: **2201100066**

Date: 13-01-2022

Issued To:

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CHIDAMBARAM COLONY, ERODE, TAMILNADU - 638001

Sample Description	:	RECYCLED PLASTIC LUMBAR
Sample Received Date	:	10-01-2022
Sample Drawn By	:	Client
Specification	:	--
Test Requested	:	TENSILE
Test Method	:	Refer to Attached Pages.
Test Result	:	Refer to Attached Pages.

SAMPLE PICTURE

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MSF 5.10.01

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TEST REPORT

Report No.: **2201100066**

Date: 13-01-2022

I. Mechanical

1. Plastics

Test performed on : 11-01-2022 to 13-01-2022

TEST	UNIT	RESULT	TEST METHOD
Tensile Strength	Mpa	12.69	ASTM D638
Elongation at break	%	34.0	ASTM D638

----------End of Report----------

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ANALYST

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TEST REPORT

Report No.: **2201100067**

Date: 15-01-2022

Issued To:

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24, KALAIMAGAL KALVI NILAYAM RD, KAIKOLAR THOTTAM,
CHIDAMBARAM COLONY, ERODE, TAMILNADU - 638001

Sample Description	:	RECYCLED PLASTIC LUMBAR
Sample Received Date	:	10-01-2022
Sample Drawn By	:	Client
Specification	:	--
Test Requested	:	Flexural Modulus
Test Method	:	Refer to Attached Pages.
Test Result	:	Refer to Attached Pages.

SAMPLE PICTURE

Terms & Conditions:-

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TEST REPORT

Report No.: **2201100067**

Date: 15-01-2022

I. Mechanical

1.

Flexural Modulus **Test performed on : 14-01-2022 to 15-01-2022**

Test Parameter	Unit	Result	Test Method
Flexural Modulus	Mpa	256.05	ASTM D790

----------End of Report----------

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Vishal Singh Tomar
ANALYST

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TEST REPORT

Report No.: **2201100070**

Date: 21-01-2022

Issued To:

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CHIDAMBARAM COLONY, ERODE, TAMILNADU - 638001

Sample Description	:	RECYCLED PLASTIC LUMBAR
Sample Received Date	:	10-01-2022
Sample Drawn By	:	Client
Specification	:	--
Test Requested	:	OXYGEN INDEX
Test Method	:	Refer to Attached Pages.
Test Result	:	Refer to Attached Pages.

SAMPLE PICTURE

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TEST REPORT

Report No.: **2201100070**

Date: 21-01-2022

I. Physical

1.

LIMITING OXYGEN INDEX **Test performed on : 17-01-2022 to 21-01-2022**

Test Parameter	Unit	Result	Test Method
Limiting Oxygen Index (LOI)	%	34.0	ASTM D2863

----------End of Report----------

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Vishal Singh Tomar
ANALYST

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TEST REPORT

Report No.: **2201100072**

Date: 21-01-2022

Issued To:

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CHIDAMBARAM COLONY, ERODE, TAMILNADU - 638001

Sample Description	:	RECYCLED PLASTIC LUMBAR
Sample Received Date	:	10-01-2022
Sample Drawn By	:	Client
Specification	:	--
Test Requested	:	THERMAL EXPANSION
Test Method	:	Refer to Attached Pages.
Test Result	:	Refer to Attached Pages.

SAMPLE PICTURE

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TEST REPORT

Report No.: **2201100072**

Date: 21-01-2022

I. Physical

1.

THERMAL EXPANSION **Test performed on : 17-01-2022 to 21-01-2022**

Test Parameter	Unit	Result	Test Method
Co-efficient of Linear Thermal Expansion	1/°C	$3.28X10^{-5}$/°C	ASTM D696

----------End of Report----------

ATMY ANALYTICAL LABS PVT. LTD. FARIDABAD

Vishal Singh Tomar
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