



Sampling plastics recyclates in Nigeria and information on the recycling situation

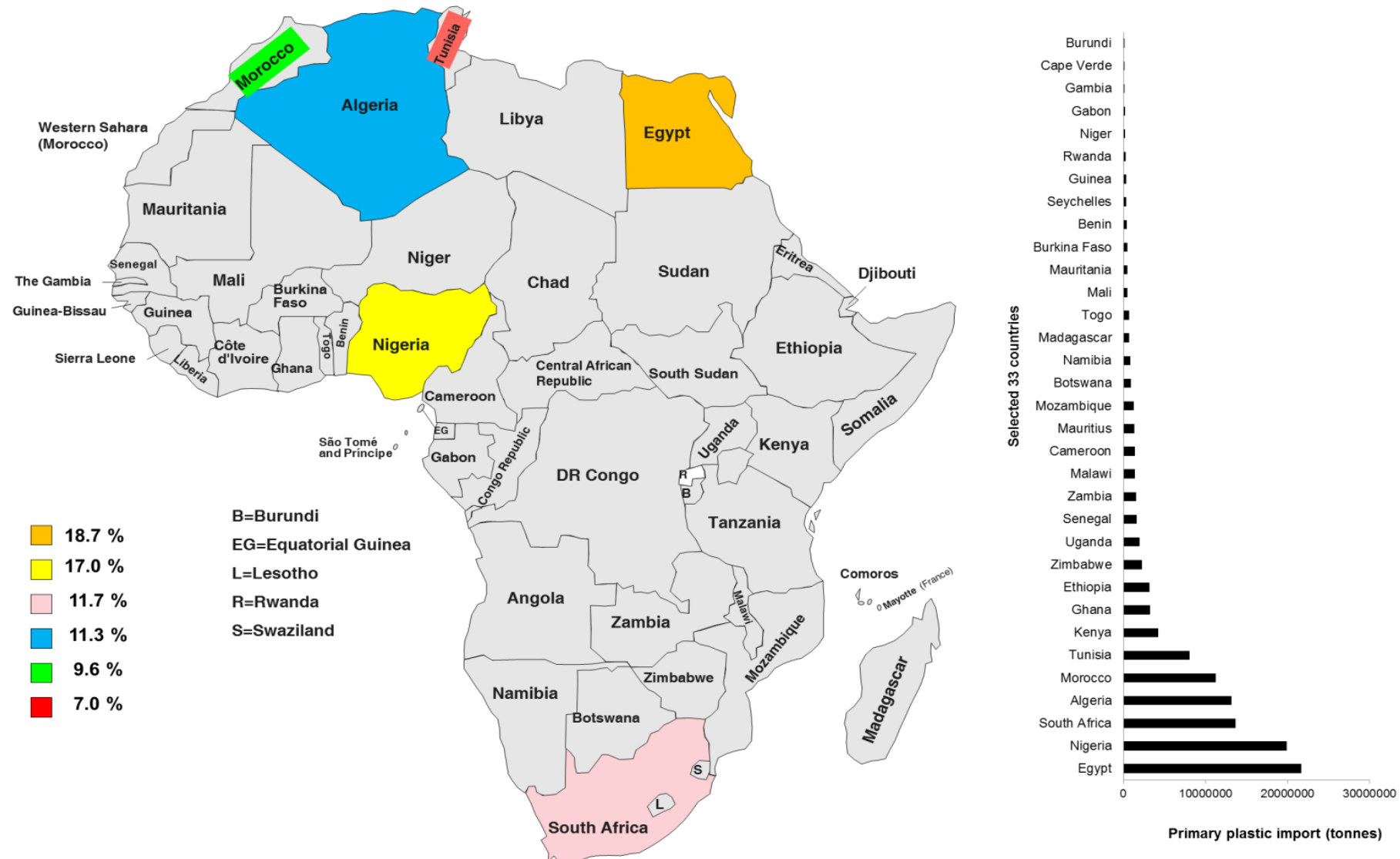
Nnorom Innocent C

(Abia State University, Nigeria; Basel Convention Co-ordinating Centre for Africa, Nigeria)



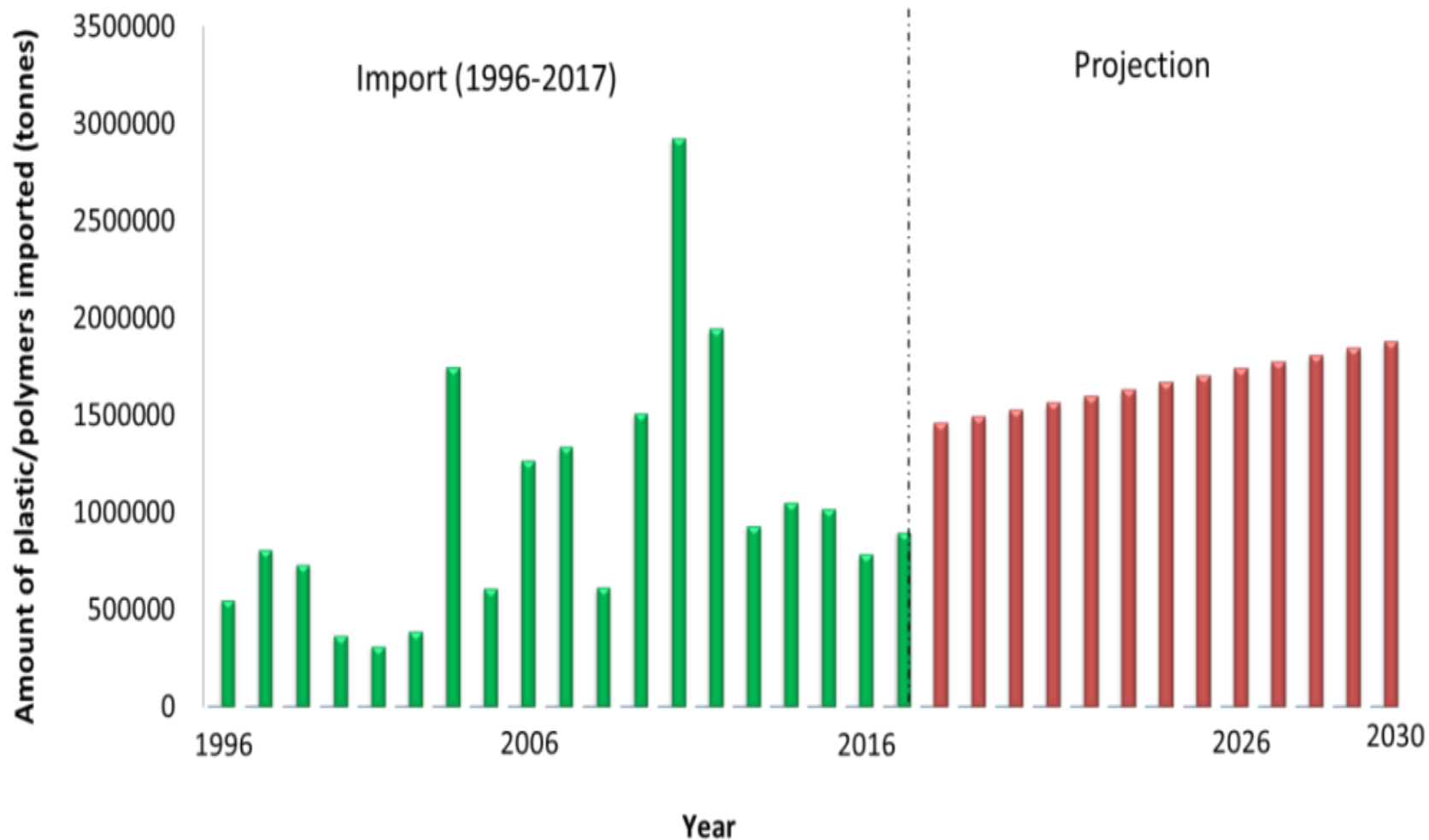
Plastics: Nigeria a major importer of plastic in Africa

- Nigeria has the second highest primary plastic import from all 54 African countries



Plastics: Import to Nigeria increased and is projected to increase

- Nigeria has the second highest primary plastic import from all 54 African countries



Plastic Waste Challenge in Nigeria

- In Nigeria, plastic waste is a visible challenge:
 - An estimated 32,000 kt of solid waste is generated/yr, with 2,500 kt of plastic waste.
 - About 200 kt of plastic waste from Nigeria is discharged into the Atlantic Ocean annually - Nigeria is among top 20 contributors of waste plastic to the oceans.
- Reasons for present situation:
 - Poor litter abatement
 - Poorly run municipal waste management systems
 - Poor implementation of existing frameworks (e.g. National Policy on Solid Waste Management and the National Policy on Plastic Waste Management approved by the Federal Government in 2020)
 - Poor consumer education and awareness campaign
- There are no official data in Nigeria for:
 - Plastic consumption or plastic products POM
 - Plastic waste generated, collected and recycled.



Plastics Recycling Situation in Nigeria

- Recyclers Assoc. of Nigeria is making efforts at compiling data
- Supply of recycled plastic to meet demand is est. at 6%.
- Large gulf between growing demand for plastic and the supply.
 - Lack of adequate collection infrastructure
 - Inadequate supply of materials to existing recycling facilities
 - Some waste plastics types are not recycled
- **The sector is dominated by informal operators**
 - They are the major collectors and they initiate the recycling process .
 - Tens of thousands of informal collectors all over the country.
 - The formal recycling companies buy directly from them.
 - They are at dumpsites, dumpsters, and walk from street to street for collection activities



Formal Waste Plastics recycling

- According to the National Bureau of Statistics, less than 10% of plastic waste generated in Nigeria is recycled
- Majority of the waste end up in landfills or water bodies.
- Nigeria is among the top ten plastic waste polluters globally and is in dire need of an effective waste management strategy, particularly in plastic recycling.
- The recycling process involves sorting, cleaning, shredding, and melting plastic waste to produce pellets, which can be used to manufacture new products such as plastic bags, bottles, and containers.
- Producers of plastic products use mostly virgin materials, others add recycled materials
- The most commonly recycled plastics include PET, HDPE, PP and PVC.



Formal operators: Food grade plastics - PET

- **Every soda and water bottle in Nigeria is made from virgin materials**
- Some foreign companies in Nigeria buy and pre-process PET before export to Europe and Asia. Sometimes they crush and hot wash before export. Some companies pre-process PET into fibre and then export. They have a network for the purchase of waste PET around Nigeria.
- **Recently Nigerian Government licensed a facility to commence recycling of food-grade PET.** The company, as at last information was finishing installation of facilities to commence operation.
- Other applications of recycled PET:
 - Production of PET straps
 - Production of fibre from PET before export to China.

The informal plastic recycling sector

- Waste plastic recycling is mainly carried out by informal sector.
 - Unregulated & focus on just the business part and the profit
 - No consideration of data collection & Environment Health and Safety.
- Activities of the Informal recyclers:
 - Collection and sorting (pre-processing) of waste plastics
 - Facilities are usually located within rural inhabited areas.
 - They do not produce pellets (they use shredded plastics).
 - Waste plastics are dumped around the facilities
 - Engage migrant workers sorts plastics according to polymer type

Sampling of recycled pellets & shreds were conducted at formal & informal recyclers

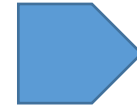
Activities of the Informal Recycling Sector



Received plastics: Separating & sorting



Sorted & ready for crushing



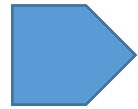
Crushing plastics



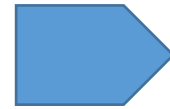
Sieving crushed plastics



Sorted & ready for use



Hopper



Moulding machine



Finished product

Using shreds to directly produce new products without making pellets

Recycling of ELV and e-waste plastics

- A recycling facility in Lagos (now closed) handled WEEE plastics - by crushing WEEE plastics and mixing with virgin polymers to make chairs.
 - On noticing this, the Lagos EPA did awareness to recyclers in Lagos on WEEE plastics recycling – emphasizing that WEEE plastics should not be used in making food grade materials.
- Informal sector operators recycle some plastics from ELV and e-waste. They focus mostly on HDPE and LDPE:
 - mostly black plastics from vehicle engine and interior and selected e-waste plastics.
 - Such plastics are crushed and sold to other recyclers or directly used to make vehicle and motorcycle parts & containers for vehicle products (e.g. Grease).



Observations: Informal Operators

- Most informal recycler:
 - unaware of the associated negative environmental and health impacts and use no PPE (except nose mask)
 - Take unnecessary risks during operations (using hand to push plastics into the crushing machines)
- Poor work environment and no safety measures
- Possibility of inhaling & ingesting the tiny plastic particles
- Poor fire safety measures
- Sieved out waste plastics are allowed to accumulate – residents use it to start fire or for cooking using locally fabricated stoves (samples are included for analysis – Japan only).



waste plastic shreds are used for cooking by locals

Plastic Types Commonly Recycled in Nigeria

- The most handled plastic types: HDPE, LDPE, PET
- Plastic types handled by a few facilities: PP, PVC
- Least handled plastic types often stored to accumulate due to no machinery, low demand, low supply, cost implications:
 - High-impact polystyrene (HIPS) and Acrylonitrile Butadiene Styrene (ABS);

Plastic types not seen during the 4 weeks sampling campaign:

- Low-impact polystyrene (LIPS); Polyamide (PA or nylon); Rubber; Expanded polystyrene (EPS); Ethylene vinyl acetate (EVA); Polycarbonate (PC).

Pellets & shreds from the individual plastic types were sampled including information on the source of plastic and the further use of the pellets and shreds.

Sampling Approach: Formal Sector

- Made a list of formal recyclers from desk study
- Consulted local waste plastic collection centres and updated the list
- Field work to the formal recyclers, but lots of challenges
 - Inaccessible: the security has list of excuses not to grant entrance
 - Bottlenecks – from HR to PM to MD: come back next week!
 - Samples are expensive and in short supply: unable to help you
- Resorted to networking
 - Engaged friends, colleagues, present/former staff of plastic companies
 - Used incentives (e.g. paying for the sample)
 - Having lunch with company personnel to motivate sample collection
- Delays and few samples collected

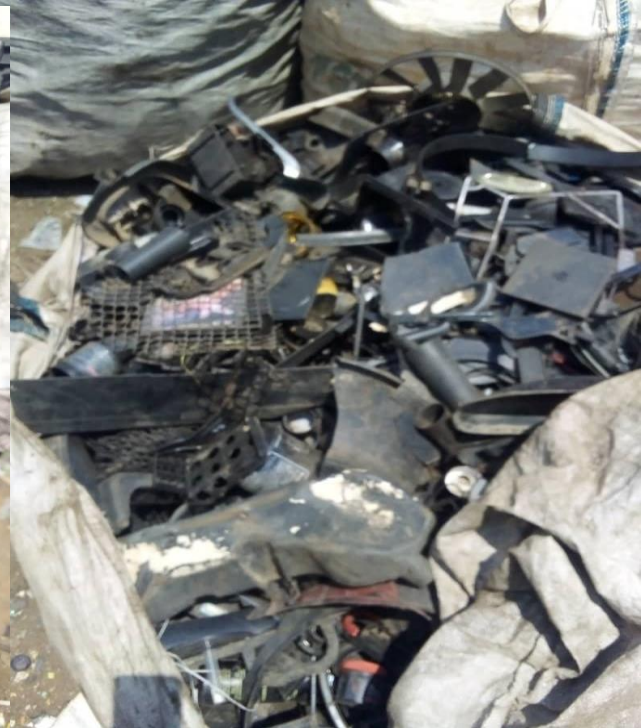
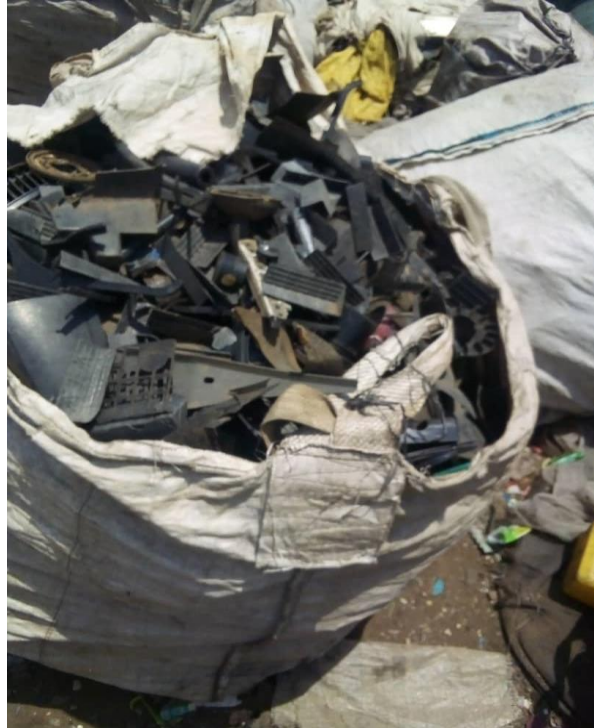
Sampling Approach: Formal vs. Informal Sector

- Networked with owners of waste plastic collection centres
 - Used their contacts in formal recyclers that they supply materials to get samples
 - Collected already crushed samples ready for supply
 - Requested for crushing of selected polymer types/products
- Liaised with informal recyclers
 - Very accessible and volunteered samples
 - Could take pictures and make videos
 - Tour of facilities & awareness creation
- Discovered an open market for waste plastics
 - Patronized by informal operators
 - Waste plastics sold on weight basis and on plastic type
 - Mostly not sorted and not crushed



Open Market for Waste plastics

In Onitsha, there is an open market for waste plastics. Recycling companies patronise dealers here for recycled plastics which they use as raw material for their production. In this market, different plastic types are sold including HDPE, LDPE, PVC, PP, etc. (also parts from e-waste and ELV)



Uses of Sampled Plastics

- Household goods: slippers, carpets, chairs, crates pillow fibres etc.
- Food grade products and kitchen wares: bottles, water tanks, buckets, jerry cans, cups, plates
- Auto parts: containers for vehicle products (e.g. grease), motorcycle parts
- Electronic accessories
- Plastic debris: waste mixed plastics not usable/recyclable but used for cooking/lighting fire

Many of recycled plastic pellets were at least partly used in food contact materials!

Summary of Sample Materials

- Forms: pellets, shreds, virgin materials, waste materials (used for cooking)
- Plastics types: HDPE; LDPE; ABS, GPPS; PP; PVC and HIPS
- Cities sampled: Aba, Lagos, Nnewi, Onitsha, Uturu, Umuahia, Enugu, Benin
- Sources: e-waste plastics, household plastics, food contact plastics, construction plastics, ELV

Typical samples



Crushed

Recycled pellet

Virgin (imported)

Collected Samples: Types/Nature

Polymer Type	Total Number	Number of Pellet	Number of Shred	Number of Virgin
Low Density Polyethylene (LDPE)	12	2	6	4
High Density Polyethylene (HDPE)	58	12	42	4
Polyvinyl Chloride (PVC)	10	0	9	1
Polypropylene (PP)	11	1	4	6
Acrylonitrile Butadiene Styrene (ABS)	4	1	3	0
General Purpose Polystyrene (GPPS)	2	2	0	0
Polyethylene Terephthalate (PET)	14	0	12	2
High-impact polystyrene (HIPS)	4	2	2	0
	115	20	78	17

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A1 Sample number

	A	B	C	D	E	F	G	H	I	J	K
1	Sample number	Polymer type	Sampling location	Sample ID	Sampling date	Pellet origin	Pellet feedstock Material	Polymer characteristics	Used additives	Pellet color	Pellet uses
2	N1	Low Density Polyethylene (LDPE)	Nigeria, Anambra, Onitsha	01 Nigeria LDPE	02/18/2023	National feedstock	ELV (End-of-Life Vehicles), e-wa	Flexible	Master batch	Black	Jerrycan (water container), grease conta
3	N2	Low Density Polyethylene (LDPE)	Nigeria, Anambra, Onitsha	02 Nigeria LDPE	02/18/2023	National feedstock	ELV, e-waste	Flexible	Master batch	Black	Jerrycan, grease container
4	N3	High Density Polyethylene (HDPE)	Nigeria, Anambra, Onitsha	01 Nigeria HDPE	02/18/2023	National feedstock	Water tanks	Flexible	Master batch	Black	Jerrycan, grease container, spoons
5	N4	Polyvinyl Chloride (PVC)	Nigeria, Anambra, Onitsha	01 Nigeria PVC	02/18/2023	National feedstock	Pipes	Semi-rigid	Master batch	Ash (gray)	Carpet
6	N5	High Density Polyethylene (HDPE)	Nigeria, Abia, Umuahia	02 Nigeria HDPE	03/07/2023	National feedstock	Water tank	Flexible	Master batch	Black	Cup, Industrial jerrycans
7	N6	High Density Polyethylene (HDPE)	Nigeria, Abia, Umuahia	03 Nigeria HDPE	03/08/2023	National feedstock	Water tank	Flexible	Master batch	Mixed	Cup, Industrial jerrycans
8	N7	High Density Polyethylene (HDPE)	Nigeria, Anambra, Onitsha	04 Nigeria HDPE	03/07/2023	National feedstock	Table, chairs, crate	Flexible	Master batch	Red	Pharmaceutical drug containers
9	N8	Low Density Polyethylene (LDPE)	Nigeria, Anambra, Onitsha	03 Nigeria LDPE	03/08/2023	National feedstock	Disposable food container, Boc	Flexible	Master batch	Mixed colour	Toast cup, disposable food container, co
10	N9	Low Density Polyethylene (LDPE)	Nigeria, Anambra, Onitsha	04 Nigeria LDPE	03/08/2023	National feedstock	Tooth brush, disposable food c	Flexible	Master batch	Mixed colour	cover for plates and plastic containers, s
11	N10	Low Density Polyethylene (LDPE)	Nigeria, Anambra, Onitsha	05 Nigeria LDPE	03/08/2023	Imported	Pellets	Flexible	Master batch	Brown	cover for plates and plastic containers, s
12	N11	Polyvinyl Chloride (PVC)	Nigeria, Anambra, Onitsha	02 Nigeria PVC	03/07/2023	National feedstock	Roofing PVC, profile PVC	Semi-rigid	Master batch	Mixed (white, milk	Carpet
13	N12	Polyvinyl Chloride (PVC)	Nigeria, Anambra, Onitsha	03 Nigeria PVC	03/08/2023	National feedstock	Roofing PVC, profile PVC	Semi-rigid	Master batch	Mixed (white, milk	Carpet
14	N13	Polypropylene (PP)	Nigeria, Anambra, Onitsha	01 Nigeria PP	03/07/2023	National feedstock	Toys, jars, cup, pellets	Semi-rigid	Master batch	White and pick	Toast cups, jars
15	N14	Polyvinyl Chloride (PVC)	Nigeria, Anambra, Onitsha	04 Nigeria PVC	03/07/2023	National feedstock	Pipe	Semi-rigid	Master batch	Ash (gray)	Carpet, pipe
16	N15	High Density Polyethylene (HDPE)	Nigeria, Anambra, Onitsha	05 Nigeria HDPE	03/07/2023	National feedstock	Waste hanger, chairs, bucket	Flexible	Master batch	Mixed(Brown, red,	Chairs, kitchen parker, cup, plate
17	N16	Low Density Polyethylene (LDPE)	Nigeria, Anambra, Onitsha	06 Nigeria LDPE	03/07/2023	National feedstock	Disposable food containers	Flexible	Nil	Transparent	Toast cup, nylon, covers
18	N17	Low Density Polyethylene (LDPE)	Nigeria, Anambra, Onitsha	07 Nigeria LDPE	03/08/2023	National feedstock	Disposable food containers	Flexible	Nil	Transparent	Toast cup, nylon, covers
19	N18	High Density Polyethylene (HDPE)	Nigeria, Anambra, Onitsha	06 Nigeria HDPE	03/07/2023	National feedstock	Water tanks	Flexible	Master batch	Black	Cups etc
20	N19	High Density Polyethylene (HDPE)	Nigeria, Anambra, Onitsha	07 Nigeria HDPE	03/08/2023	National feedstock	Water tanks	Flexible	Master batch	Black	Cup etc
21	N20	High Density Polyethylene (HDPE)	Nigeria, Anambra, Onitsha	08 Nigeria HDPE	03/07/2023	National feedstock	Water tanks	Flexible	Master batch	Black	Cup, jerry cans, buckets
22	N21	High Density Polyethylene (HDPE)	Nigeria, Anambra, Onitsha	09 Nigeria HDPE	03/08/2023	National feedstock	Water tanks	Flexible	Master batch	Black	Cup, jerry cans, buckets
23	N22	Polyvinyl Chloride (PVC)	Nigeria, Anambra, Onitsha	05 Nigeria PVC	03/07/2023	National feedstock	Sandals or footwear	Semi-rigid	Master batch	Black	Slippers, carpet
24	N23	Polyvinyl Chloride (PVC)	Nigeria, Anambra, Onitsha	06 Nigeria PVC	03/08/2023	National feedstock	Sandals or footwear	Semi-rigid	Master batch	Black	Carpet
25	N24	Polypropylene (PP)	Nigeria, Anambra, Onitsha	02 Nigeria PP	03/07/2023	National feedstock	Toys, jars, cup, pellets	Flexible	Master batch	White and pick	Pallets, plastic bottles, beverage cup
26	N25	Polypropylene (PP)	Nigeria, Abia state, Umuah	03 Nigeria PP	03/11/2023	National feedstock	Crate	Felxible	Master batch	Red	Crate
27	N26	High Density Polyethylene (HDPE)	Nigeria, Enugu, Enugu	10 Nigeria HDPE	03/11/2023	National feedstock	Pellets	Felxible	Master batch	Blue	Cup, jars, industrial container

Sample list

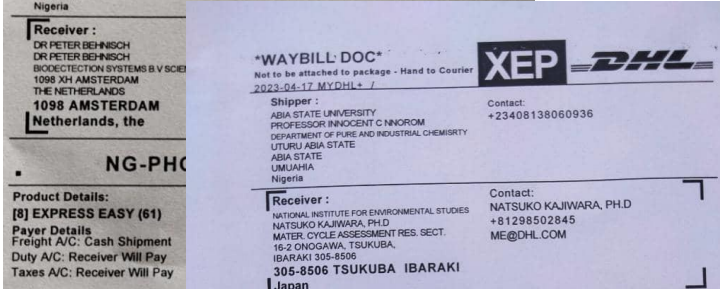
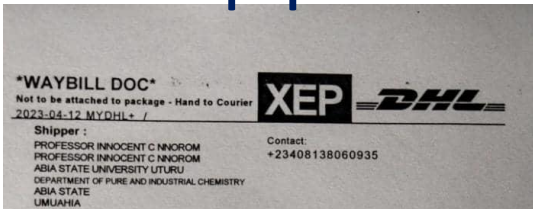
Further instructions

Count: 13



Packed Samples

Shipped



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Clearance Event
April, 16 2023 16:02 Local time, LEIPZIG - GERMANY
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Notification for shipment event group "Delivered" for 03 May 23.

AWB Number: **6222706770**
Pickup Date: 2023-04-12 23:05:00

Ship From: UMUAHIA, NG
Ship To: MAUERN, BYBavaria DE

EVENT CATEGORY
03 May 23 8:44 AM - Delivered -

DHL - DO... 11:31 AM to me

Notification for shipment event group "Delivered" for 20 Apr 23.

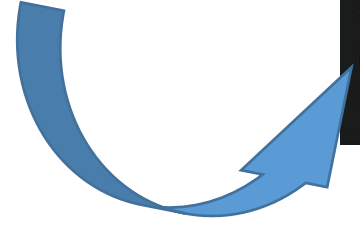
AWB Number: **8401081570**
Pickup Date: 2023-04-13 13:21:57

Ship From: UMUAHIA, NG
Ship To: BARCELONA, ES

EVENT CATEGORY
20 Apr 23 12:29 PM - Delivered - BARCELONA, SPAIN



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