

## 14.4 Comparison of types of plastics research

### Macroplastics and microplastics

There is a very dominant interest in microplastics from the scientific literature examined (Figure 1.2.14.5). Although quantification of marine plastic debris or macroplastics is also reported in grey literature, it is often without the same rigour and level of details. There is also a clear lack of research on examining both macro- and micro-plastics or primary and secondary plastic particles in general to understand the process of transformation from the former to the latter.

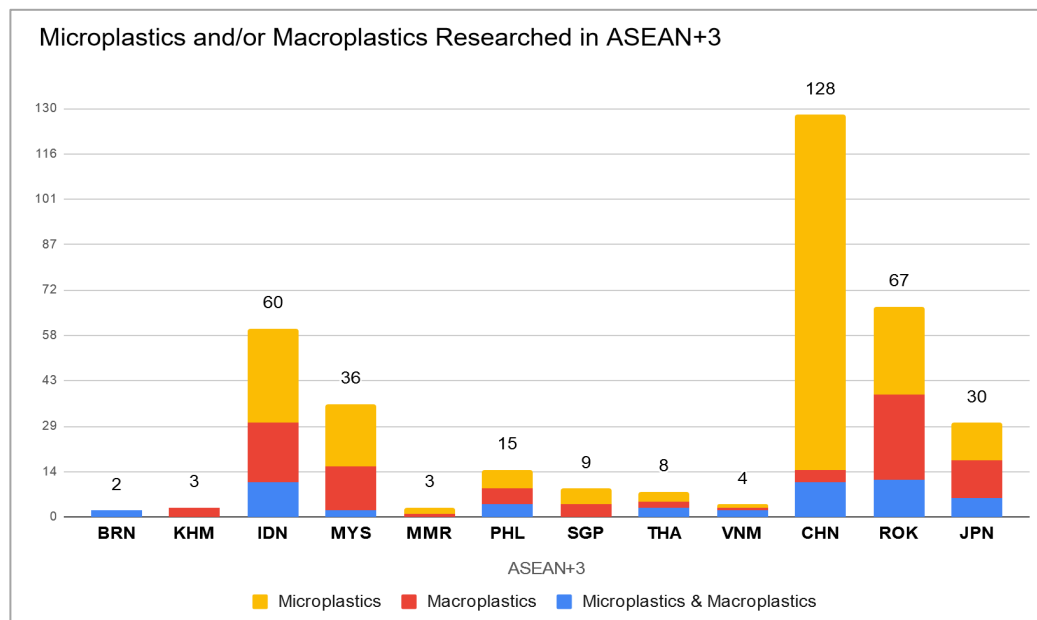


Figure 1.2.14.5. Research efforts on micro-/macro- plastics in the ASEAN+3.

### Polymer types

Table 1.2.14.6 below provides a compilation of all polymers identified or studied in ASEAN+3, with a selection of the top five types of plastic polymers in each country in terms of research effort (i.e. number of publications). Overall, this shows that the most commonly studied polymers are PP, PE and PS across ASEAN+3.

When looking at the regional research effort as a whole (i.e. lumping all publications together, irrespective of the country of interest) the same top three plastic polymer is obtained. However, a substantial research effort can also be noted for another 14 types of plastic polymer, including PET, PVC, PA, EPS, SAN, LPDE, nylon and cellophane (Table 1.2.14.7).

Table 1.2.14.6. List of plastic polymer types identified and the top 5 in the research reviewed.

\* In some countries with too few articles that mention polymer types, the top 5 polymers could not be deduced

|            | All plastic polymer types identified  | Top 5 plastic polymer types*  |
|------------|---|-------------------------------|
| <b>BRN</b> | PET, PE, PVC  | (only 1 study)                |
| <b>KHM</b> | -   | -                             |
| <b>IDN</b> | PP, PS, PE, PET, LDPE, polyester, synthetic cellulose, PVC, PU, PC, PBD, PA, nylon, HDPE, EDPM, dipar, CP   | PP, PS, PE, PET, LDPE         |
| <b>MYS</b> | PP, PE, PET, PS, PVC, PA, nylon, LDPE PVA, polyisoprene/polystyrene, PEP, PAN, PAK, HDPE, EPS, CP   | PP, PE, PET, PS, PVC          |
| <b>MMR</b> | -   | -                             |
| <b>PHL</b> | GPPS, PE, PET, PA, PP, PVC, LDPE, PETE, rayon, phenoxyresin, acrylic  | PE, PVC                       |
| <b>SGP</b> | PE, PP, PVC, PVA, nylon, acrylonitrile butadiene styrene  | PE, PP, nylon                 |
| <b>THA</b> | PS, PET, PA   | (only 1 study)                |
| <b>VNM</b> | PE, PP, PET, PP-vistalon, polyester, rayon, viscose, acrylic, resin   | (only 1 mention in 2 studies) |
| <b>CHN</b> | PE, PP, PS, PET, PVC, PA, CP, LDPE, polyester, nylon, rayon, PC, HDPE, EPS PU, PES, PE/PP, PTFE, acrylic, POM, alkyd, SAN, PVA, PP/EPR, PMMA, PBT, wax, urethane alkyd, synthetic cellulose, resin, PVDC, PVAC, PV, PP/EPDM, PSUL, polyphenylene, polyethylene/ethylacrylate copolymer, PAN, poly(1-octene), PEVA, PCL, PBAT, PB, PARA, PAE, MDPE, EVA, epoxy, cellulose, ASA, AN, alkyd, ABS | PE, PP, PS, PET, PVC          |
| <b>ROK</b> | EPS, PE, PP, PS, acrylic, vinyl, PVC, PU, PET, nylon, alkyd, styrene oligomers, polyester, polyacrylate/styrene, PEVA or EVA, LDPE, teflon, styrene/acrylonitrile, silicone, PTFE, PVA, polystyrene ethylene butylene styrene, PPS, polyethylacrylate styrene, polyepoxides PC, PBT, PMMA, PCB, PBMA, paraffin, PA HDPE, XPS, ABS   | EPS, PE, PP, PS, acrylic      |
| <b>JPN</b> | PS, PE, PP, PVC, resin, PA, PET, PCL, PAK, EVA, PVA, PMMA, PEPD, PEP, PC/ABS, nylon, FPS  | PS, PE, PP, PVC, resin        |

Table 1.2.14.7. List of plastic polymers studied in the research reviewed.

| Polymers  | No. of papers |
|---|---------------|
| Polyethylene (PE)   | 126           |
| Polypropylene (PP)  | 107           |
| Polystyrene (PS)  | 95            |
| Polyethylene terephthalate (PET or PETE or PETP or PET-P) | 64            |
| Polyvinyl chloride (PVC)                                  | 56            |
| Polyamide (PA)  | 39            |
| Expanded polystyrene (EPS)                                | 31            |

|                                  |    |
|----------------------------------|----|
| Styrene-acrylonitrile (SAN)      | 23 |
| Low-density polyethylene (LDPE)  | 19 |
| Nylon                            | 19 |
| Cellophane (CP)                  | 15 |
| Polyester                        | 15 |
| Polyurethane (PU or PUR)         | 12 |
| Acrylic                          | 11 |
| Polycarbonate (PC)               | 10 |
| High-density polyethylene (HDPE) | 10 |
| Rayon                            | 10 |

### Regulations on plastic polymers under examination

While the top four most researched plastic polymers are the subject of some regulation under international law, it is interesting to note that the following polymers, which are also the subject of substantial research effort, are not the subject of specific international law provisions (Table 1.2.14.8). These include, in particular:

- PVC
- EPS
- SAN
- LDPE
- Nylon
- Cellophane

Conversely, some plastic polymers which are regulated for their potential toxicity and are found in the marine environment do not appear to be the subject of much research effort. These include PA, PU, acrylic polymers and PB.

Further research would be useful. First, to ensure in-depth study of the most prevalent and toxic polymers in the marine environment. Second, to investigate consistency between research outcomes and regulations as well as across international regulations (see [Part 1, Section 3.7](#) on toxic contaminants regulation for further discussion on this).

Table 1.2.14.8. Number of publications on organic contaminants (plastic polymer types) in ASEAN+3.

Legend: Red = not regulated under any of the three conventions (London Convention/London Protocol, Basel Convention and the Stockholm Convention); Green = under the regulation of at least 1 of the mentioned conventions. [A complete table of all researched polymers can be found in [Appendix IV.](#)]

| Organic contaminants (plastic polymer types) |               |                                 |               |
|--|---------------|---------------------------------|---------------|
| Regulated                                    | No. of papers | Unregulated                     | No. of papers |
| Polyethylene (PE)                            | 126           | Polyvinyl chloride (PVC)        | 56            |
| Polypropylene (PP)                           | 107           | Styrene-acrylonitrile (SAN)     | 23            |
| Polystyrene (PS)                             | 95            | Low-density polyethylene (LDPE) | 19            |

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|   |    |                                  |    |
|---|----|----------------------------------|----|
| Polyethylene terephthalate (PET or PETE or PETP or PET-P) | 64 | Nylon                            | 19 |
| Polyamides (PA)   | 39 | Cellophane (CP)                  | 15 |
| Expanded polystyrene (EPS)                                | 31 | Polyester                        | 15 |
| Polyurethane (PU or PUR)                                  | 12 | Rayon/viscose                    | 11 |
| Acrylic polymers  | 11 | High-density polyethylene (HDPE) | 10 |
| Polycarbonate (PC)  | 10 |                                  |    |