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perplexity

Key Take-away

Vitamin D made from marine algae (or lichen/sea-weed) starts with a raw material that is **consistently shown to trap and carry microplastic particles; lanolin does not.** Modern pharmaceutical processing removes almost all solids from either source, so the finished vitamin D ingredient is very unlikely to contain measurable plastic, but—if any trace were to survive—algae-derived material is the more plausible route.

Why algae carries a higher microplastic load

1. **Algae and seaweeds act as "plastic sponges."** Field surveys repeatedly detect fibres and fragments tangled on or embedded in kelp, nori and other macro-algae, typically from coastal waters where microplastics are abundant.
    - Kelp and nori contained 0.9 – 3.0 items g^{-1} dry weight in 24 commercial brands of packaged seaweed[1].
    - Mexican retail seaweeds averaged 24 ± 9 items g^{-1} and reached a pollution-load index of 3.7 – 6.0[2].
    - Kelp forests were "hot spots," with plastics found at every trophic level, starting in the algal fronds[3].
    - A 2024 exposure assessment calculated that seaweed now contributes up to 45% of total dietary microplastics in some East-Asian diets[4] [5].
2. **Laboratory work confirms active retention.** Macro-algae trap fibres through adherence, wrapping and embedment; micro-algae can even ingest 1–10 µm spheres, altering growth and nutrient uptake[6] [7].
3. **Extraction steps do not necessarily remove all particulates.** Vitamin D_3 from algae is usually obtained by solvent or super-critical-CO_2 extraction of dried biomass followed by crystallisation. Unless very fine filtration (<1 µm) is built in, sub-micron plastic fragments could co-purify with lipophilic compounds.

Why lanolin poses a lower microplastic risk

1. **Lower environmental burden.** Terrestrial sheep do ingest plastic from contaminated soils, and microplastics have been measured in faeces (~1 000 items kg^{-1})[8] [9] and in edible tissues (≈0.13 items g^{-1})[10], but direct measurements in wool grease are lacking and expected to be lower than in marine settings.
2. **Lanolin production includes aggressive purification.**
    - Raw wool is scoured, the grease is separated, then pharmaceutical-grade lanolin undergoes multi-stage distillation, bleaching, carbon/earth filtration and molecular sieving.

- Analyses of nipple-care lanolin found pesticide traces at the parts-per-million level but reported no particulate contamination after processing[11].
- Pharmacopeial monographs require final lanolin to pass <1 µm filtration and visual particle tests[12].

3. **Vitamin D₃ isolation from lanolin adds yet another round of filtration and recrystallisation.** 7-Dehydrocholesterol is saponified, solvent-extracted, crystallised and UV-converted to cholecalciferol, with each stage removing insolubles.

Practical implications

Aspect	Lanolin source	Algae source
Typical microplastic burden in raw feedstock	Low: land-based, limited atmospheric fallout; no direct contact with marine debris	High: marine environment; algae surfaces accumulate 0.9–24 items g^{-1} (multiple studies) [4] [2] [1]
Mandatory purification steps before vitamin D manufacture	Multi-stage distillation, bleaching, sub-micron filtration; pharmacopoeial particle limits [11] [12]	Solvent/CO_2 extraction and crystallisation; filtration level varies by manufacturer
Published detection of microplastics in refined ingredient	None reported	None reported, but raw material carries significant load and removal efficacy unreported
Relative likelihood that traces could persist into final vitamin D	**Lower**	**Higher**

Bottom line

Both forms of supplemental vitamin D are highly refined. Nonetheless, because marine algae are repeatedly documented to accumulate and even internalise microplastics while lanolin is produced from a less contaminated terrestrial source and then subjected to stricter particulate-removal steps, **algae-derived vitamin D carries the higher theoretical risk of microplastic carry-through** into the finished ingredient.

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1. https://pubmed.ncbi.nlm.nih.gov/31955027/
2. https://www.sciencedirect.com/science/article/abs/pii/S0963996923013881
3. https://pubmed.ncbi.nlm.nih.gov/38824984/
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