



2H Structured Media PP vs. PVC

At present about 25% of 2H structured media is made from polyvinyl chloride (PVC) and 75% from polypropylene (PP). We claim to have gained considerable experience of both products over the past 15 years.

2H find PP media has the following advantages:

- **It is more consistent in properties than PVC**
- **Stronger than PVC**
- **Has better operational properties such as wetting**
- **Is less expensive to produce and sell**
- **Healthier for the work force**
- **Has a lower cost of ultimate disposal**

Some of these findings are apparently contrary to published polymer property data and so require clarification and expansion. As is often the case, it is "not what you do but how you do it" which provides the explanation.

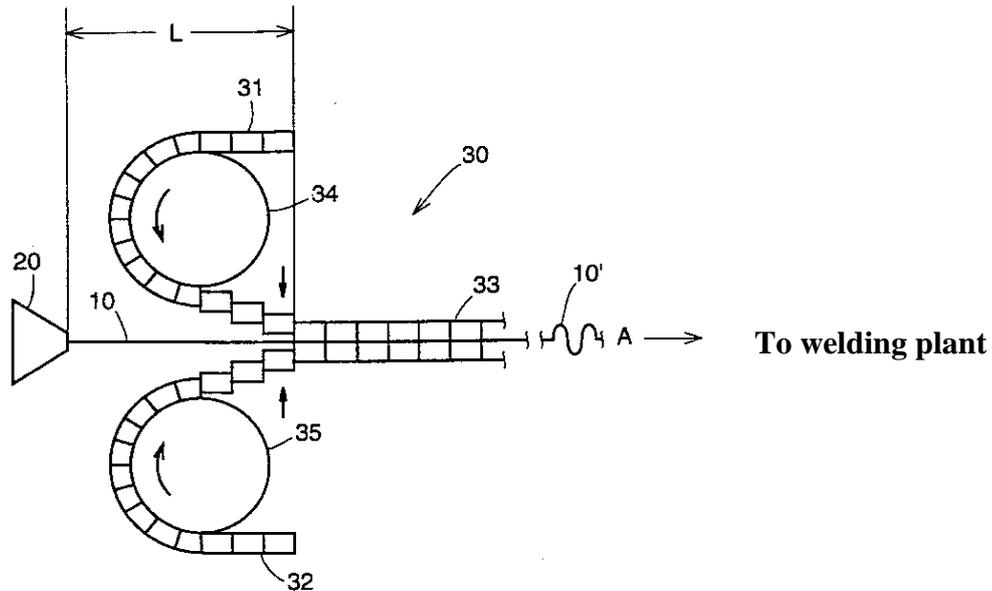
Consistent properties

All PVC media is made from reground scrap. It is calendared to a flat sheet, usually by a specialist manufacturer. Then the media producer thermo or vacuum forms the sheet to a corrugated or profiled surface which is then trimmed to size. The sheets are coated with solvent based adhesives, stacked into a jig and left to dry. Sometimes, aqueous based adhesives are used but these produce weaker bonds and they also contain some solvent.

PP media is made from virgin polymer compounded with inert additives and passed through a standard plastic sheet extruder. The molten extruded sheet is fed directly into a revolving forming tool, cut to length and welded into blocks in one continuous process. The automatic welding device controls temperature, pressure, time and cooling cycle to close tolerances.

PP blocks produced by this method have fewer steps in their production and, importantly, the polymer is subjected to least two less melting cycles than glued PVC. Every time a polymer undergoes a melting cycle, some degradation occurs.

With PP the handwork element of gluing is removed. Overall, the human factor is much reduced.



PP is stronger than PVC

Not according to published data: this indicates that the ultimate tensile strength of typical PVC is about 160% that of typical PP. Yet 2H PP blocks can be produced which sustain the weight of fully loaded articulated trucks. Similarly, it is possible to build heavily loaded high rate filters to 8m depth or more from PP media.

Following extensive independent evaluations by the TÜV in Germany, 2H are able to warrantee their PP dynamic loading solutions for 30year+ lifetimes. So far this has not been done for glued PVC.

2H PP media achieve their exceptional mechanical performance for the following reasons:

- The density difference between PVC and Polypropylene polymers is about 40%. This allows thicker foils to be made from PP for equivalent weight to PVC offsetting the strength difference.
- The 2H process allows strengthening of the media block where the loads are heaviest
- The compounded fillers significantly improve the long-term strength properties of the PP block.



2H Foil-thickness variation



PP and some PVC media contain UV additives to improve weatherability. Evaluation is ongoing. So far, long term tests (10 years) indicate similar results for PVC and PP media i.e. good resistance. It is predicted, however, that the greater foil thickness of PP media could give it the edge over the long term. In Western Europe projected life for both PVC and PP media is in excess of 30 years.

PP media has better operational properties such as wetting

Studies by CAMRE at Porton Down, originally into the growth of Legionella in pipework, show that the growth of biomass on PP is more rapid than on PVC. This leads to faster filter start-ups from PP. Meeting outlet consents within two weeks is not unusual.

The compounding of PP with fillers has the effect of roughening the surface and reducing the surface energy of PP media. In practice, this allows enhanced wetting and biomass retention. Independent studies show the performance of cooling tower fill from 2H media is virtually identical to PVC. This would not be the case for unmodified PP.

PP has generally better chemical resistance than PVC and its continuous operating temperature is at least 80degC compared to PVC's 55degC. This is of considerable importance for cooling tower operation.

In the field, 2H PP media is significantly more robust than PVC. This allows faster initial installation, safer walk-on conditions and easy removability of blocks for routine biomass inspections.

PP media is less expensive than PVC to produce and to sell

Generally speaking PVC polymer is less expensive than PP polymer but PP media is often less expensive than PVC media because:

- The weight per specific volume of PP is less than PVC (0.91: 1.42) - This is only partly negated by the greater thickness of 2H PP media foils
- Precise control of sheet thickness by the 2H manufacturing process
- Fewer manufacturing steps
- Automated process (lower labour costs)
- No glue
- No solvent recovery plant investment and operation costs



PP is healthier for the workforce than PVC

Matters of health are always contentious as most materials can be hazardous if mishandled. 2H strongly recommend that all users of plastics materials strictly follow manufacturer's safety requirements.

PVC is halogenated and is built into blocks by using solvent based adhesives. Such products can be toxic even in small amounts and especially, when ingested or inhaled over prolonged periods.

Halogens and solvents are absent from PP media and from its construction processes. So risks associated with them are also absent. It is also worth noting that, in the instance of those hazards mentioned here, when PP media is used, the possibility of an afflicted person bringing legal action against a user who persists in purchasing PVC media when a safer alternative is available is also eliminated.

PP has a lower cost of ultimate disposal than PVC

PVC is a halogenated product. Already, in certain parts of Europe disposal by landfill except under very special circumstances and at great cost is prohibited for this class of chemical. Similarly, incineration is very expensive.

It can be expected that the trend towards greater harmonisation of regulations throughout Europe will create a situation where the inevitable disposal of PVC media may prove more expensive than the initial installation.

At present PP can be disposed by landfill without additional cost penalties. Being non-halogenated it can also be incinerated at less cost than PVC.



The disadvantages of PP compared to PVC

This review has concentrated on the many advantages of PP over PVC. In so far as media for cooling or bio applications are concerned, there are few instances where PVC has the advantage over PP.

Ignitability is one area where PVC has advantages over PP. Although both plastics do burn, it is more easy to set PP alight than PVC. This poses a relatively small risk in cooling towers and biofilters which in operation are continuously drenched. But it is not a risk which 2H discount or would want to minimise: especially on the construction site where clear operating and safety instructions are always issued.

Over the past 14 years 2H has supplied media for more than 250,000 units of one sort or another. So far, we have received just one report of a fire involving PP media. This occurred when a competitor deliberately set fire to a block on a client's car-park in an attempt to discredit PP - 2H won the contract.

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