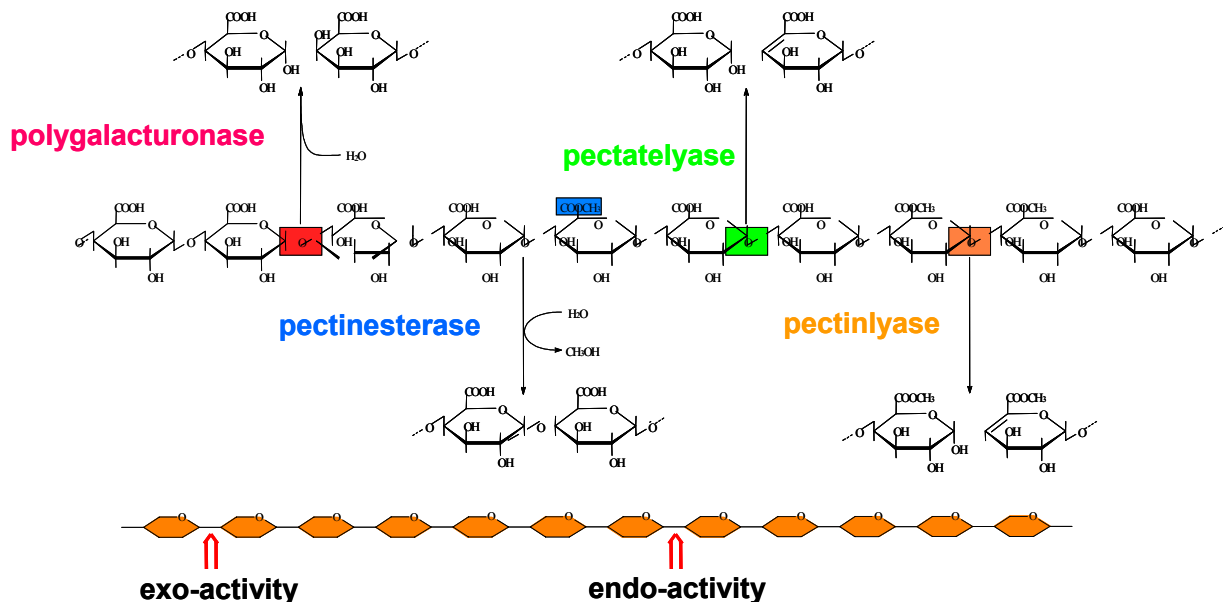


Pectin hydrolysis with Trenolin® Mash DF and Trenolin® Thermo DF

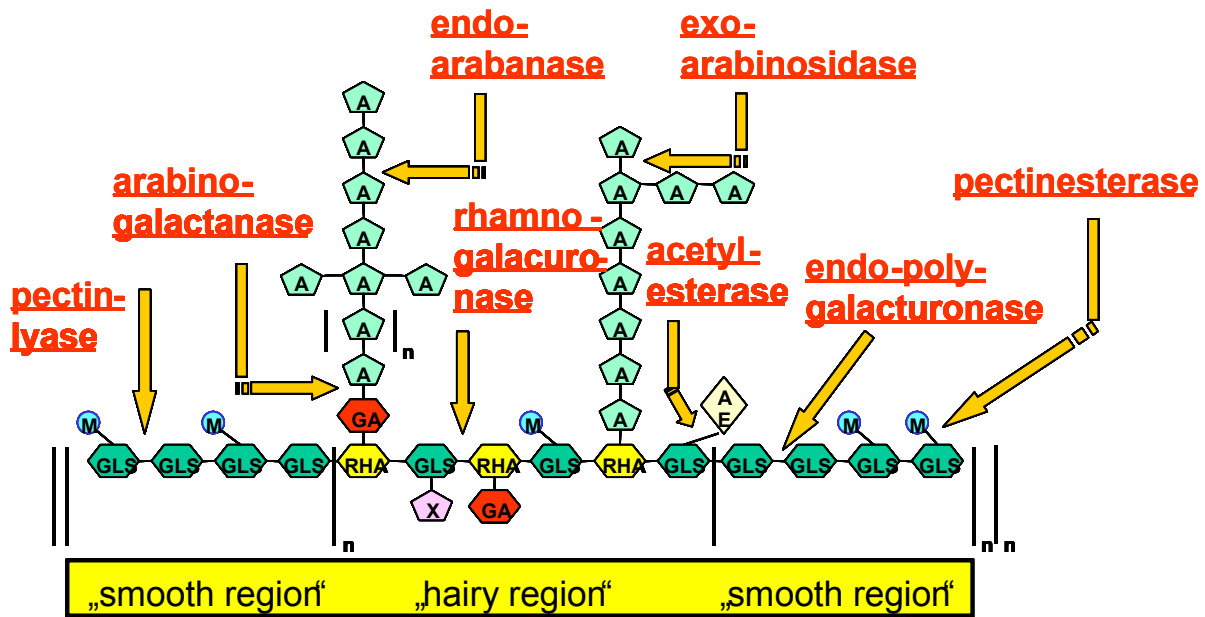
The pectin splitting effect of pectinase preparations is not a singular activity but is a combined effect of several single activities each of which leads to a different reaction in the pectin molecule (Fig. 1).

The “classical” pectinase fractions and their mode of operation in pectin degradation



Four pectinase main activities are distinguished which contribute to the degradation of the dissolved pectin (hydropectin): pectinesterase (PE, PME), polygalacturonase, pectin lyase and pectate lyase. Sometimes they are even also divided into endo- and exo-enzymes. In addition to this there are pectinase activities which attack high-molecular undissolved pectin (protopectin) and convert this into soluble pectin. Such pectinases are called maceration enzymes. Their single pectinolytic activities are so far not completely analysed. Among these, above all, also the endo-polygalacturonase must be mentioned. Other possible activities are named pectin glycosidase, protopectinase or macerases. Because pectin is not a homogeneous substance with a uniform molecule structure, but is composed rather heterogeneously (Fig. 2), besides the known main pectinase activities also other enzymes are necessary for a complete pectin degradation, which are in the meantime classed among the pectinases due to their effect on the “hairy regions” of the pectin molecule, pectinase fractions which are difficult to degrade. Among these are, for instance, rhamnogalacturonase, arabanase/arabinosidase, acetylcetase and others.

New model of the pectin molecule with description of the enzyme activities necessary for hydrolysis



A = arabinose	AE = acetyl ester	GA = galactose
GLS = galacturonic acid	M = methyl ester	RHA = rhamnose
X = xylose	n = undetermined number	

Besides homogeneous structures which are composed of single-bound individual units of galacturonic acid („smooth regions“), also heterogeneous sections („hairy regions“) can be found in regular intervals in the pectin molecule. Each of these consist of an irregularly composed main chain with branched lateral chains of different lengths. In the main chain rhamnose units disconnect the galacturonic acid molecules making degradation by „classical“ pectinase impossible. This means, one of the new pectinase activities – the rhamnogalacturonase – is required for degradation. The lateral chains branching off from the main chain mainly consist of arabinose molecules which are partly linked by galactose bridges. These side chains are called arabinogalactans or arabans and require for complete degradation arabanase, arabinogalactanase and arabinosidase activities, which also belong to the new pectinase activities. At the point of linkage of the „smooth“ and „hairy“ regions an acetyl ester group is contained and constitutes a molecule interfering with the degradation of the „hairy regions“. For an enzymatic attack on the „hairy regions“ this ester group has to be split off at first. For this purpose acetyl-esterase is employed which therefore has to be classed with the new pectinase activities. Due to the combination of these new pectinase activities with the classical pectinases the colloid hydrolysis can be realized to a greater extent, including the pectin sections in the „hairy regions“ which are difficult to break down.

All these findings and correlations are integrated into the new innovative Erbslöh enzymes *Trenolin® Mash DF* for MashZeration and *Trenolin® Thermo DF* for Thermo-Vinifikation. The quantitative composition of the required enzyme fractions of the new *Trenolin®* enzymes is conceived according to their requirement profile. With *Trenolin® Mash DF* and *Trenolin® Thermo DF* efficient „bio-tools“ are available for the oenologist so that the vinification of white and red wines according to high quality standards can be realized.

Trenolin® Mash DF

In modern white wine vinification the rest periods of the crushed grapes should be kept as short as possible because of microbiological reasons. Yet the oenologist would rather have a better digestion of the grape skin and increased aroma release. At the same time the uptake of unwanted polyphenols and bitter substances should be kept as low as possible. On the one hand the classical method of “steeping/leaching” the crushed grapes suits the aims of the oenologist but, on the other hand, it increases the risk of microbiological infection, especially in crushed grapes which are still warm from picking and not yet cooled down. The new Erbslöh *Trenolin®*-MashZeration with *Trenolin® Mash DF* – a highly efficient and newly conceived pectinase complex – is a shortened enzymatic „contact time on the mash for soaking purposes“ which achieves an intensification of aroma and at the same time minimizes the risk of quality being negatively affected by wild micro-organisms.

The *Trenolin®*-MashZeration with *Trenolin® Mash DF* is based on a pectinase complex which contains, besides the „classical“ pectinase fractions, also all the important „new“ pectinase activities, which, according to the most recent findings of colloid chemistry, are above all necessary for the hydrolysis of the difficultly degradable pectin structures („hairy regions“). Further useful and valuable side activities complete the pectinase complex. The following table shows the most important enzyme activities of *Trenolin® Mash DF*, how they react and their advantages for the oenologist.

Enzyme complex in <i>Trenolin® Mash DF</i>	Effect and advantage
Pectin esterase	Drastic viscosity lowering of the liquid portion of crushed grapes, resulting in improved free juice run-off.
Endo-polygalacturonase	Weakens the pectin structure in the fruit tissue and prepares the release of desired cell ingredients as, for instance, primary aromas.
Acetyl esterase	Removes the interfering molecule at the point of linkage of difficultly and easily degradable pectin so that the „hairy regions“ can be attacked.
Rhamnogalacturonase	Cleaves rhamnogalacturonan so that the pectin breakdown of the difficultly degradable pectin fractions is supported.
Arabanase/arabinosidase	Splits off the lateral branches in the difficultly degradable pectin fraction. This reduces the proportion of dissolved colloidal macro-molecules.
β-glucosidase	Liberates monoterpen alcohols. Promotes the typical fruit and aroma profile which is characteristic for the respective fruit variety.
Proteinase	Cleaves the cell wall proteins which are released by the pectin degradation in the fruit tissue. This reduces the colloids which might cause cloudiness.

Due to the especially good mazeration properties of *Trenolin® Mash DF* the *Trenolin®*-MashZeration effects a rapid destabilisation of the pectin structure in the fruit tissue which results in a considerable increase of free juice run-off. The necessary pressure for pressing can be reduced which significantly lowers the uptake of phenols into the must so that the risk of producing astringent and bitter wines is minimized. The variety-typical fruit and aroma profile is enhanced by the β -glucosidase side activity. Moreover, by the MashZeration with *Trenolin® Mash DF* the self-clarification of the must is increased and the effect of *Erbslöh-Mostgelatine* respectively *PrePur* in preventive must treatment is supported. Of course *Trenolin® Mash DF* is free from undesired depsidase activities (cinnamolyesterase activities) to further promote the positive effect of this enzyme complex.

Trenolin® Thermo DF

The red wine boom is undiminished and the consumers appreciate well structured wines with intensive colour and distinct fruit flavours. In red wine vinification the tendency towards mash heating is getting stronger all the time which makes possible quicker processing and better utilization of rotten grapes. With *Trenolin® Thermo DF* a new enzyme is available for the oenologist which is particularly suited for thermo-vinification.

Within shortened rest periods *Trenolin® Thermo DF* effects an improved extraction of colour and of catechins relevant for colouring matter. Shortened contact times also mean earlier pressing and further cooling down so that microbiological risks are reduced. Along with the more complete digestion of the grapes due to the good maceration properties of *Trenolin® Thermo DF*, additional primary aromas are released. Since pectin degradation is intensified, the free juice run-off is facilitated and the necessary pressing pressures can be reduced. The uptake of bitter phenolic off-flavours into the must is thereby significantly lowered.

Enzyme complex in Trenolin® Thermo DF	Effect and advantage
Pectin esterase	Drastic viscosity lowering of the liquid portion of the mash, thus an improved free juice run-off respectively a better solid-liquid phase separation in the decanter.
Endo-polygalacturonase	Weakens the pectin structure in the fruit tissue and prepares the release of desired cell ingredients as, for instance, catechins and primary aromas.
Proteinase	Cleaves the cell wall proteins in the fruit tissue released by pectin breakdown and denaturated during thermal treatment. Thus foam formation and colour losses by precipitation of protein/colour agglomerates are reduced.
Rhamnogalacturonase	Cleaves the rhamnogalacturonan and supports pectin degradation of the difficultly degradable pectin fractions.
Acetyl esterase	Removes the interfering molecule at the point of linkage of the difficultly and easily degradable pectin so that the „hairy regions“ can be attacked.
Arabanase/arabinosidase	Splits off the lateral branches in the difficultly degradable pectin fraction so that the proportion of dissolved colloidal macro-molecules is reduced.



A colloid structure which is increased and strongly modified by thermal stress often leads to great problems during clarification and filtration. The „new“ pectinase fractions of *Trenolin® Thermo DF*, however, carry through a further breakdown of the disturbing colloids from the difficultly degradable pectin structures of the „hairy regions“ and make clarification and filtration much easier. This effect is supported by useful proteinase side activity.

Trenolin® Thermo DF and decanter technology

Due to the high efficiency of the various enzyme activities of *Trenolin® Thermo DF* it is possible to employ the decanter technology in large-scale plants. The decanter technology is characterized by a very rapid processing of large quantities of crushed grapes which come in within a short time period. The resulting extreme mechanic stress on the grape mash, which arises on top of the thermal stress, modifies the colloid structure of the decanter must enormously. In addition to the load of thermally released colloids the very fine colloidal sediment particles further inhibit clarification and filtration. These very fine colloidal particles can hardly be observed visually but coat the tongue leaving an unpleasant tannic sensory effect. With *Trenolin® Thermo DF* the must is treated in a way which makes the subsequent clarification very efficient. This also has a positive influence on the following filtration of the young wines. Moreover, with the removal of the very fine colloidal matter the negative tannic characteristics disappear. Of course, undesired depectinase activities (cinnamolyesterase activities) and oxidase activities are removed from *Trenolin® Mash DF* and this further improves the positive effect of this enzyme complex.